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PLANT COMMUNITY DEVELOPMENT ON ABANDONED PETROLEUM DRILL SITES WITHIN THE BRIDGER-TETON NATIONAL FOREST IN WESTERN WYOMING

Project Final Report
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PREFACE

Reclamation of disturbances associated with extensive oil/gas exploration and development in the West has received minimal research emphasis. The consequent lack of information has severely hampered impact mitigation programs. Nowhere is this problem more evident than within the Overthrust Belt and adjacent areas in western Wyoming, eastern Idaho and northeastern Utah, where various federal agencies and the petroleum industry desperately need information upon which to base reclamation programs. This project was the result of that need. It was conceptualized and designed to yield basic ecological information on drill site recovery within a specified portion of the region (The Bridger-Teton National Forest) upon which future applied reclamation programs may be more soundly built.

This final report consists of two parts: a narrative and an assemblage of appendices. The narrative is designed to describe the project and present synthesized results pertinent to research objectives. The appendices present supplemental information and a complete set of the project data upon which the narrative was based. The latter are included not only to provide certain data not discussed in the narrative but to also provide a complete data set for future, additional interpretation.

This project would not have been possible without the financial support and cooperation of the Logan, Utah station of the U.S. Forest Service Intermountain Forest and Range Experiment Station. Particular thanks are due to Bland Z. Richardson (Station Project Coordinator) and Eugene E. Farmer (Logan Station Leader) for their active contributions, encouragement and patience. The active cooperation of personnel of the Bridger-Teton National Forest was also essential to completion of the project, and is gratefully acknowledged. Lastly, contributions of various faculty members and former staff members of the College of Agriculture, University of Wyoming were necessary for the implementation and conclusion of this study and both are recognized and appreciated.

ABSTRACT

Plant community development was determined on a series of 17 abandoned oil/gas exploratory drilling sites occupying both sagebrush and coniferous vegetation types within the Bridger-Teton National Forest. Sites ranged from 3 to 33 years in age since abandonment. Some of the sites received reclamation treatment at the time of abandonment, while others revegetated naturally. Vegetation and soils were sampled on both disturbed sites and adjacent undisturbed sites for comparative purposes.

Both vegetation and soil characteristics were altered by drilling activities. None of the disturbed sites exhibited vegetation closely resembling that of adjacent native sites. However,sites within the sagebrush vegetation type were recovering towards an undisturbed condition more rapidly than sites within the coniferous type. Disturbed site soils generally lacked horizonation, had both higher bulk density and pH and less organic matter than the adjacent undisturbed soils. Applied reclamation practices accelerated the successional process in terms of both vegetation and soil development, although at different rates between sagebrush and coniferous disturbances. Establishment of introduced grass communities, via seeding, on disturbed sites did not appear to inhibit natural recolonization of native species.

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INTRODUCTION

Exploration and development of oil and gas resources has increased dramatically in the western United States during the last several decades. Several large oil and gas fields have been discovered in western Wyoming, which is located in a petroleum rich province known as the Overthrust Belt (Anschutz, 1980). Such discoveries have led to increased interest in this geologic formation, which stretches from Canada to Mexico, occupying portions of Montana, Idaho, Wyoming, Utah and Arizona.

Exploration and production related activities disturb ecosystems in a number of ways. Roads must be developed to facilitate access to drill sites. Road construction removes vegetation and topsoil, compacts subsoil layers and can result in extensive soil erosion of cutbank slopes if proper designs are not implemented. Sites designated for drilling are also severely impacted. Forest Service guidelines require that all vegetation be removed and a minimum of one foot of topsoil/subsoil be stripped from the site and stockpiled. The site is then graded and compacted using heavy equipment to provide a stable base for the drilling rig and associated equipment. A reserve pit is excavated and made large enough to accommodate drilling fluids and any additional water volume contributed by run-off. Ancillary disturbances also occur such as loss of habitat and forage for domestic livestock and wildlife, impacts on the hydrology of the area, and altered esthetic values.

Ecosystem disturbance is further complicated by the fact that drilling occurs under widely different environmental conditions. Many of the major oil and gas fields discovered within the Overthrust Belt occur in the mid-elevation semiarid, sagebrush grass region of the Green River Basin (VerPloeg, 1982). Exploratory drilling has also occurred in sagebrush steppe areas, montane forests, and in subalpine areas. Each area presents a different set of climatic, edaphic, physiographic and biotic characteristics to be considered in the design of reclamation programs.

Present laws require reclamation of lands disturbed by oil/gas development, mining, road building or pipeline construction (Moore et al., 1977). Reclamation must yield conditions in which vegetation is self-sustaining under natural conditions and able to support the land uses prescribed for the area. Approximation of predisturbance vegetation conditions comprises one (although not the only) means of accomplishing this, and consequently is often implied as a reclamation goal.

Plant community development is more similar to secondary than primary succession due to the fact that salvaged/replaced topsoil is weathered, once supported vegetation, and contains organic matter, nutrient accumulation, seeds and propagules from the original vegetation (Wali, 1980).

After a temporary disturbance, secondary successional processes usually tend to reconstruct something resembling the original undisturbed community. This sequence of change is usually the result of site modification and interspecific competition, where pioneer species establish in openings and gradually create an environment in which later seral species are competitively superior (Horn, 1974). Studies have been conducted within various ecosystems to determine the time required for a plant community to reestablish naturally after some form of disturbance. Tisdale and Hironaka (1981) reported that a

minimum of 40 years is required for reestablishment of sagebrush on abandoned croplands in eastern Wyoming. Approximately 20 to 40 years are required in the Central Great Plains region for natural restoration of grasslands onto abandoned croplands (Judd, 1940). A study of successional development following fire in grand fir (Abies grandis) communities in western Montana estimated 39-90 years for canopy and understory cover to resemble that of mature stands (Antos and Shearer, 1981). Ronco (1976) estimated as much as 200 to 300 years for climax spruce-fir vegetation to reinhabit a high elevation disturbed site. Studies in the alpine environment have noted very little vegetation colonizing 30 year old mining disturbances (Brown et al., 1976). Researchers have stated that the time necessary for natural alpine revegetation cannot be determined with present knowledge (Brown and Johnston, 1980).

Such findings indicate that reclamation techniques must be utilized to direct and accelerate the process of secondary succession on disturbed lands if reclamation within a reasonable time frame is desired. To be effective, such applied reclamation practices should be thoroughly and properly based upon site-specific ecological relationships involved in succession. A recognition and knowledge of successional processes and causal factors thus comprise an essential base for design of successful reclamation programs.

Numerous studies have been conducted to identify factors controlling the process of plant community succession on disturbed lands. Emphasis has been placed on both natural succession on nontreated, abandoned disturbed lands and on disturbed lands treated with reclamation practices (Skilbred, 1979; Jaynes and Harper, 1978; Redente et al., 1981; Sindelar, 1978). These studies have yielded valuable information concerning the role of inter- and intra-specific competition among species, biotic and abiotic factors and climate in the successional development of plant communities. Although results of such studies sometimes may be extrapolated to other areas and types of disturbances, it is best to conduct research on the specific area and type of disturbance being considered.

The subject of drill site reclamation has received very little attention, with the exception of studies concerning the effects of drilling muds on plant growth (Miller et al., 1980; Moseley, 1980; Younkin and Johnson, 1980; Nelson et al., 1980). There is a notable lack of information on revegetation of lands disturbed by exploratory and production related activities. Due to the predicted increase in oil and gas exploration in the Overthrust Belt and the environmental controversy that surrounds some projects (Bureau of Land Management and Forest Service, 1983), there is a need for research on both applied reclamation methods and plant community development associated with drilling related disturbances.

Objectives

As of 1981, ninety-one abandoned drill sites existed within the Bridger-Teton National Forest of western Wyoming.[1] These sites ranged in age from 54

[1]The term abandoned is applied to a drill hole which did not yield any oil or gas and has been permanently closed with all rigging and equipment removed from the site.

to 3 years since abandonment and occupied a wide range of elevations, exposures, topographies, soils and life zones. Certain sites have revegetated under natural secondary succession only. Others were recontoured and/or reseeded at the time of abandonment. This project was initiated to study plant community development following drilling disturbance as influenced by time and a wide range of physical and biological conditions.

Basic study objectives were to:

(1) Evaluate the present successional status of the disturbed communities in reference to adjacent undisturbed communities and suggest the amount of time which may be required for recovery of these areas to a pre-disturbance condition.

(2) Evaluate the effects of the type of native vegetation surrounding the drill site on the rate of native species and overall community reestablishment.

(3) Determine effects of seeding and other applied reclamation practices on the reestablishment of indigenous species.

(4) Identify plant species which appear to be well adapted to colonization on the disturbed sites and which may prove to be beneficial species for reclamation purposes.

(5) Determine what soil properties are altered by drilling disturbance and the possible effect of such on vegetation establishment.

STUDY AREA

Location

The Bridger-Teton National Forest is located in northwestern Wyoming. It is situated between Yellowstone National Park to the north, Grand Teton National Park and the Targhee National Forest to the west and the Shoshone National Forest and the Continental Divide to the east (Fig. 1). This forest covers approximately 1.4 million hectares, making it the largest national forest within the contiguous United States.

Geology and Physiography

The Bridger-Teton National Forest region has experienced a complex geologic history resulting in a wide diversity of physiographic features. The forest includes portions of five mountain ranges; is dissected by a series of basins and major river drainages and is underlain by the petroleum rich Overthrust Belt.

The predominantly granitic Wind River Mountain Range is located within the Pinedale District on the eastern segment of the forest. The Gros Ventre Mountains to the northwest of the Wind River Range are composed of layered sedimentary rock. Peaks and valleys found in both of these ranges are largely the result of glaciation. Mountains in the southwestern portion of the forest are included in a faulted and thrusted sedimentary formation known as the Wyomide Range. These linear ranges from northeast to southwest are the Hoback Range, the Wyoming Range and the Salt River Range (Blackstone, 1971). This faulted region is a small segment of the Overthrust Belt, in which numerous petroleum deposits have been discovered trapped within the extensive network of contorted strata (Fig. 2). Elevations in the forest range from 1,726 m on the Snake River at Alpine to peaks of 4,200 m in the Wind River Range (Youngblood and Mueggler, 1981).

Soils

Soils in the Bridger-Teton region contain four orders: Alfisols, Entisols, Inceptisols and Mollisols. Many of these soils have evolved under a cryic temperature regime which is defined as having mean annual soil temperatures greater than 0°C, but less than 8°C, short, cool summers and a short growing season (Soil Conservation Service, 1975). Due to this temperature regime, many of the soils are further classified into great groups with a Cryo prefix. These soils are further subdivided into an array of subgroups, with Typic, Lithic and Argic being the most common. Argic Cryoborolls are the major soils in the region, interspersed with a mosaic of other soil types (personal communication, Melissa Blackwell, Soil Scientist Bridger-Teton National Forest, Jackson, WY).

Soil texture, depth, horizonation and nutrient composition vary according to the type of deposition, mineralogy of parent material, prevailing weather patterns and physiography. Due to these factors, the diverse array of soil subgroups and the complex geologic history of this region, there are a wide variety of soil series and associated vegetation types within the forest.

FIGURE 1. Location of the Bridger-Teton National Forest

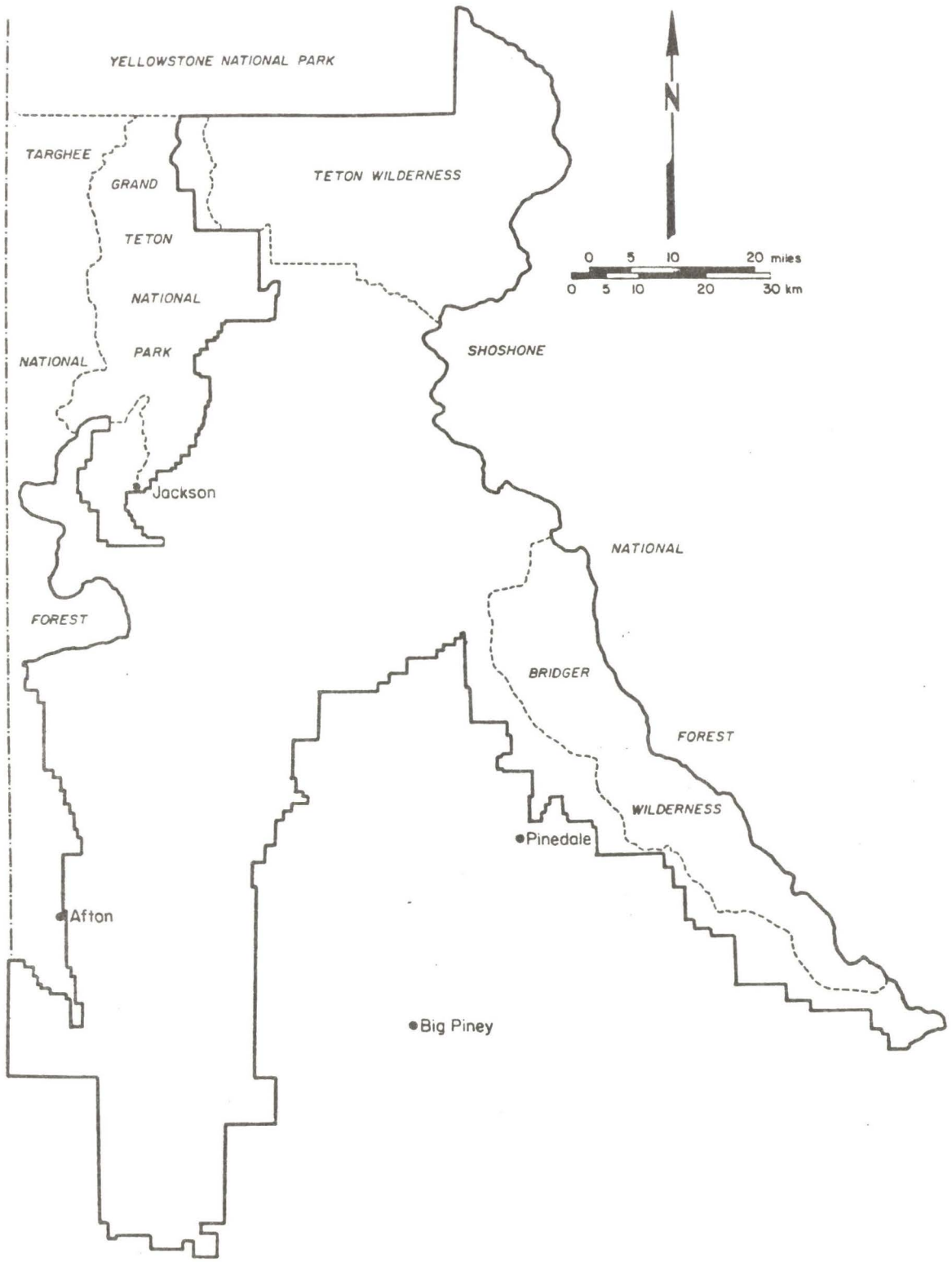
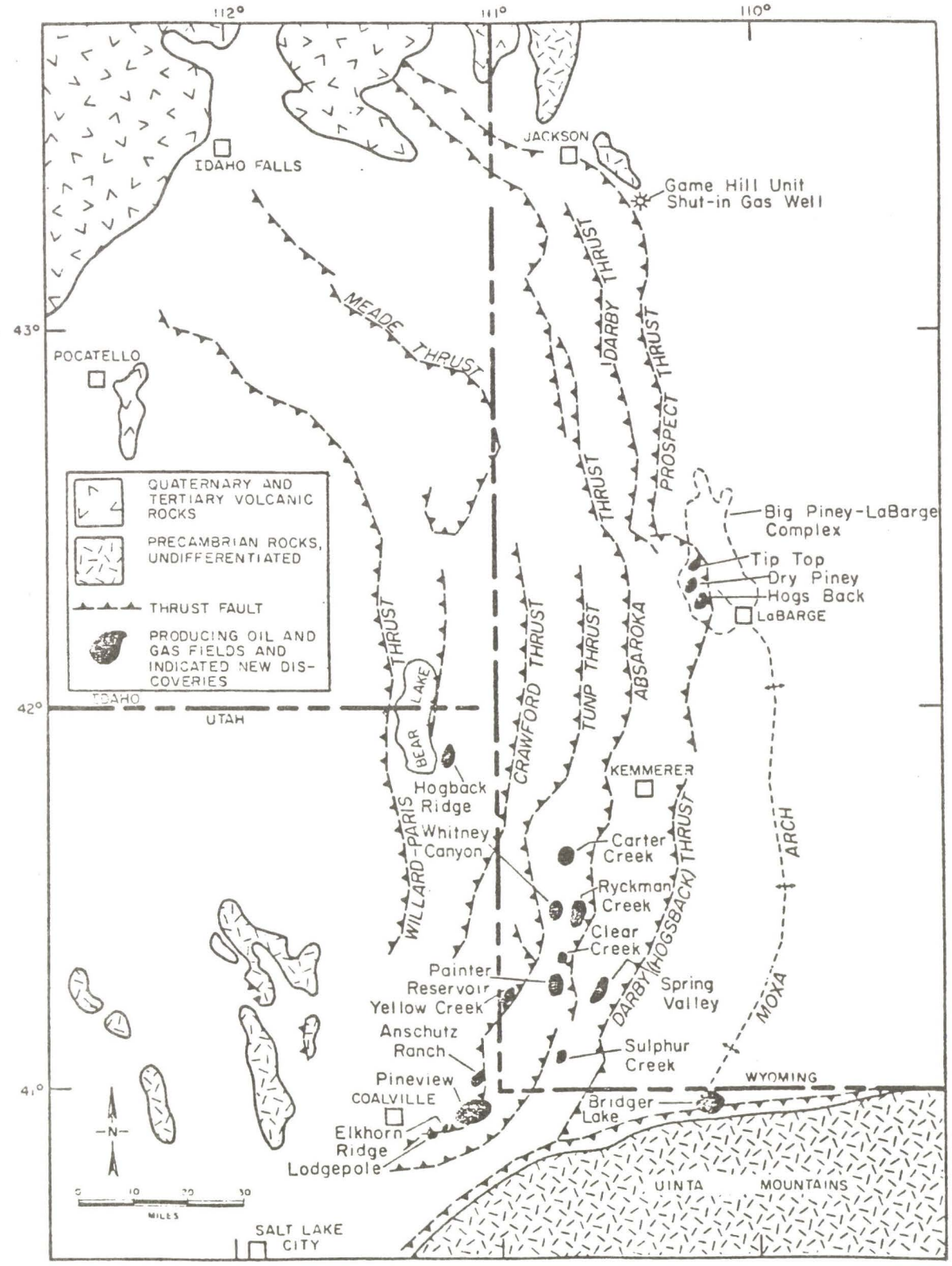


FIGURE 2. Oil and gas fields in the Overthrust Belt (from VerPloeg, 1979).



Climate

Many climatic differences occur due to the size and topographic variation of the Bridger-Teton National Forest. The climate of Jackson, representing the northwestern portion of the forest, is classified as cold-snowy-forest with humid winters. In contrast, the climate of Big Piney, located near the forest's southeastern boundary is described as semi-arid (Alyea, 1966; 1970). Overall, this area can be characterized as having short cool summers, long cold winters and prevailing westerly winds (Bramble-Brodahl, 1978).

Most precipitation occurs as snow, which comprises as much as three-fourths of total annual precipitation. Maximum and minimum temperatures exhibit a wide range both seasonally and diurnally. Summertime freezes are common due to rapid nighttime radiation cooling. Sunshine is common, with an estimated average of 40 percent possible sunshine in the winter to 80 percent in the summer. Relative humidity is generally low throughout the year, with an annual average of approximately 55 percent (Alyea, 1966, 1969, 1970).

Sites sampled during this study were widely dispersed throughout the forest, in terms of both location and elevation. Data from seven weather stations located around and within the forest were used to estimate climatic conditions at each site. Climatic data from these stations were averaged for the 33 year period from 1949 to 1982. All sites intensively sampled were drilled and abandoned within this time frame. Figure 3 shows the location of the weather stations and average annual precipitation for the Bridger-Teton region. Appendix A lists total annual precipitation and frost free days for each station. Average annual precipitation for the 33 year period varied widely among stations, from a low of 22cm at Big Piney to a high of 58cm at Moran.

Temperature and precipitation are very much dependent on elevation and exposure. Baker (1944) reported an average decrease of 1.8°C for every 304 m rise in elevation and a corresponding increase in precipitation with elevation in western Wyoming. He suggested the following figures for precipitation and length of growing season as influenced by elevation:

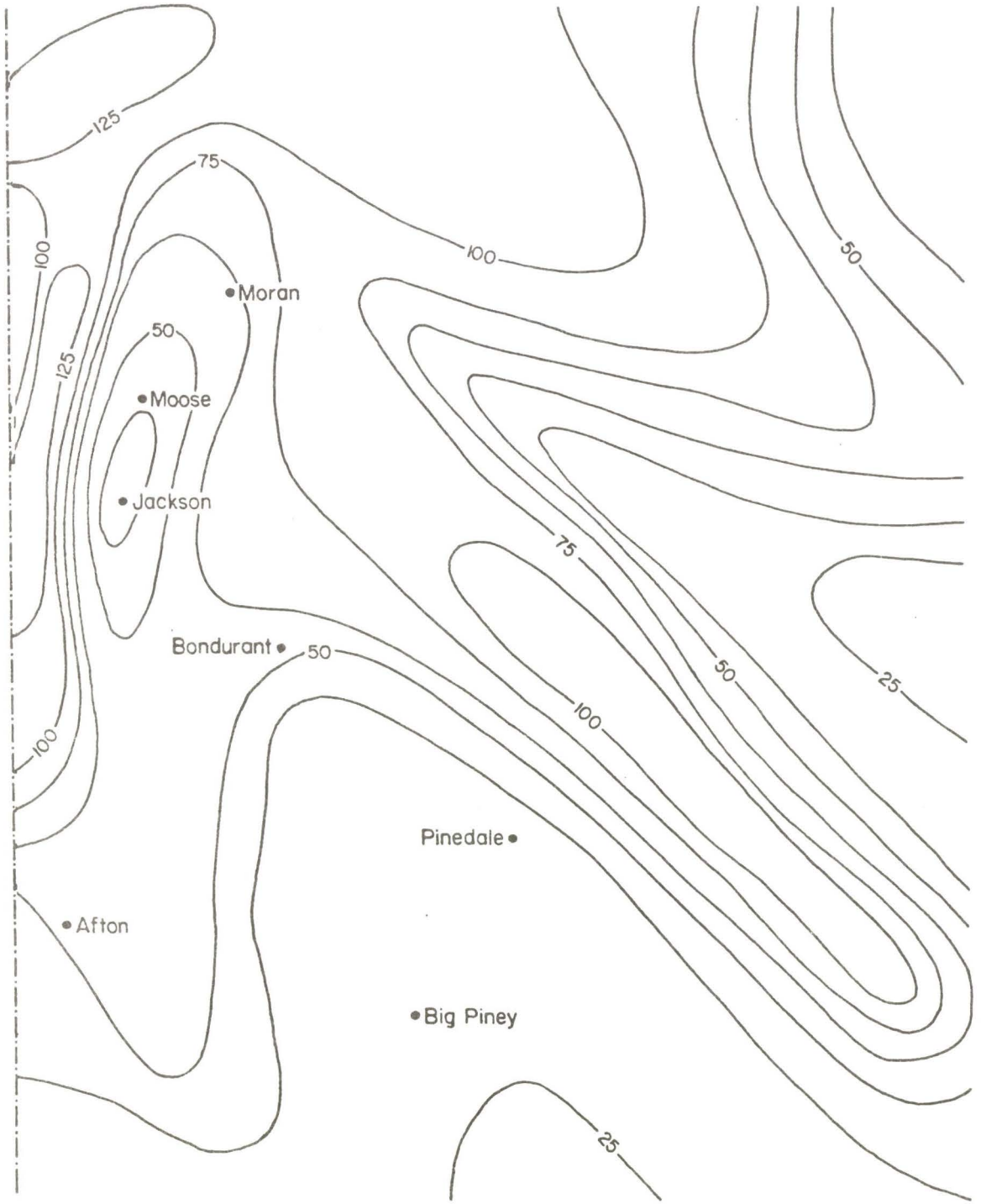
Elevation (m)	Precipitation (cm)	Length of Growing Season (days)
1829	43	210
2134	56	185
2438	64	165
2743	76	135
3048	>76	105

These relationships and weather station climatic data were used to estimate actual climatic conditions affecting sampled sites. This was necessary because many of the sites sampled were located at elevations greater than that of any of the weather stations.

Vegetation

Plant communities within the Bridger-Teton Forest are as diverse as the microclimate, soils and physiography that influence their distribution. Major

FIGURE 3. Location of weather stations and average annual precipitation in cm for the Bridger-Teton Region.



vegetation formations include grasslands, shrublands, forb meadows, aspen groves, riparian zones, coniferous forests and alpine meadows (Youngblood and Mueggler, 1981).

Shrublands cover a large portion of the forest and are dominated by a variety of shrub species. The sagebrush (Artemisia) - grass vegetation occurring within the Gros Ventre Range District has been classified into habitat types (Bramble-Brohdahl, 1978). These types are also found in other portions of the forest. Artemisia cana, Artemisia tridentata ssp. tridentata, Artemisia longiloba, and Artemisia arbuscula with their associated subdominant shrubs and grasses are typically found in moist and mesic sites at mid elevations (2130-2290 m). Artemisia tridentata ssp. vaseyana, Artemisia longiloba, Artemisia cana and Artemisia rothrockii can be found in conjunction with a variety of dominant grasses and forbs on upper elevation sites ranging from 2130 m to 2740 m. Other shrubs such as Chrysothamnus nauseous, C. viscidiflorus, Xanthocephalum sarothrae and Purshia tridentata are associated with the Artemsia complexes.

Coniferous vegetation covers much of the forest. Pinus contorta covers many hectares in nearly pure stands at mid elevations on gently rolling terrain. These stands can intergrade into nearly all other coniferous vegetation types, with the exception of the upper elevation Pinus flexilis type. Pseudotsuga menziesii stands are also found within the forest, at elevations ranging from 1650 m along the Snake River to 2900 m in the Wind River Range (Steele et al., 1979). Picea englemanii, Abies lasiocarpa and Pinus albicaulis are commonly found on north and eastern slopes at upper elevations of between 2440 m to 3050 m (Negus and Findley, 1959). Pinus flexilis occupies the driest and harshest sites capable of supporting trees, usually occurring on upper treeline, rocky sites.

Aspen (Populus tremuloides) groves are also very common throughout the forest. This vegetation has been classified into 26 community types by Youngblood and Mueggler (1981). Aspen and associated understory vegetation can be found within a broad range of elevations (1710 m to 2840 m) on all aspects and all slopes within the forest, but are typically indicators of moist soil conditions.

Alpine meadows are encountered at elevations above 2590 m. These areas are typically dominated by sedges (Carex spp.) and a variety of grass species. Adapted forbs such as Lupinus, Potentilla, Phlox, Myosotis, and Oxytropis are often common in these upper elevation communities (Beetle, 1961).

Land Uses

Due to its large size, diverse habitats and close proximity to two popular National Parks, the Bridger-Teton Forest provides a variety of land uses. Two designated wilderness areas exist within its boundaries - the Teton and The Bridger.

The forest provides forage and habitat for a great number of animal species. Domestic cattle, sheep and horses utilize the high mountain, shrub steppe and grassland ranges existing throughout the region. Moose, antelope, mule deer, elk and big horn sheep can be found in both summer and winter at various elevations and vegetation types. Smaller mammals such as badger,

coyote, fox, beaver and marmot and a wide array of bird species also abound (Negus and Findley, 1959).

The Bridger-Teton Forest offers numerous recreational opportunities to thousands of visitors each year. Camping, hiking, horseback riding, skiing, snowshoeing and snowmobiling are popular ways of viewing the scenery, wildlife and vegetation occurring in the forest. Numerous lakes, rivers and creeks attract fishermen, canoers, kayakers and white water rafters. Big and small game as well as bird hunting enthusiasts find the Bridger-Teton a suitable setting for this sport.

Timber stands contribute both to the scenery and the economy of the area. Aspen, Engelman spruce, Douglas fir, subalpine fir, whitebark pine and limber pine protect watersheds and provide necessary habitat for birds and wildlife. Lodgepole pine, Douglas fir and Englemann spruce are harvested under sustained yield management programs by local lumbermills (Forest Service, 1980).

Due to the forest overlying the Overthrust Belt, much past and present attention has been paid to possible oil and gas deposits. Most of the forest has been or will be surveyed using seismic testing methods. Many exploratory drilling operations have been implemented. Several major discoveries have been made, prompting the possible development of natural gas fields in such places as Riley Ridge, located in the Big Piney District (Bureau of Land Management and Forest Service, 1983). Such discoveries have stimulated an increasing number of companies to apply for permits to drill in unexplored portions of the forest.

METHODS AND PROCEDURES

Extensive Survey

Intensive sampling of drill site vegetation and soils was considered mandatory to accomplish stated research objectives. Since it was impractical to intensively sample all 91 sites in the forest, an extensive survey and analysis was conducted to select sites for intensive investigation.

In 1981, 83 of the 91 abandoned drill sites within the Bridger-Teton National Forest were located. Fig. 4 indicates the locations of these sites. An on-site investigation was conducted for each site. Sites were numbered and located on U.S. Forest Service maps and on U.S.G.S. 7.5 minute topographic quadrangles. Actual locations of sites were checked against map locations and adjusted as necessary. Ground information not printed on the maps, such as roads, was added to aid in future field reconnaissance.

Slope, aspect, and elevation were recorded for each site. Slope was measured using a clinometer. Elevations given in well records were verified against the U.S.G.S. topographic maps and were adjusted if necessary.

Plant species were identified and listed at each site and its adjacent undisturbed native community. Dominant species were recorded first, with other identifiable species included after.

At each site, observations were made on general sampling suitability, the most suitable area for sampling native vegetation and whether the site appeared to have received some form of reclamation treatment. Recorded information on reclamation practices implemented on older sites was very limited, so much had to be induced through visual inspection. Other items noted were accessibility and any unique characteristics. Numerous photographs were also taken.

Each site was mapped for approximate size and configuration. The length and width of the disturbed area was measured. These distances were recorded on a diagram of the site. Vegetation types surrounding each site were also depicted on the diagrams.

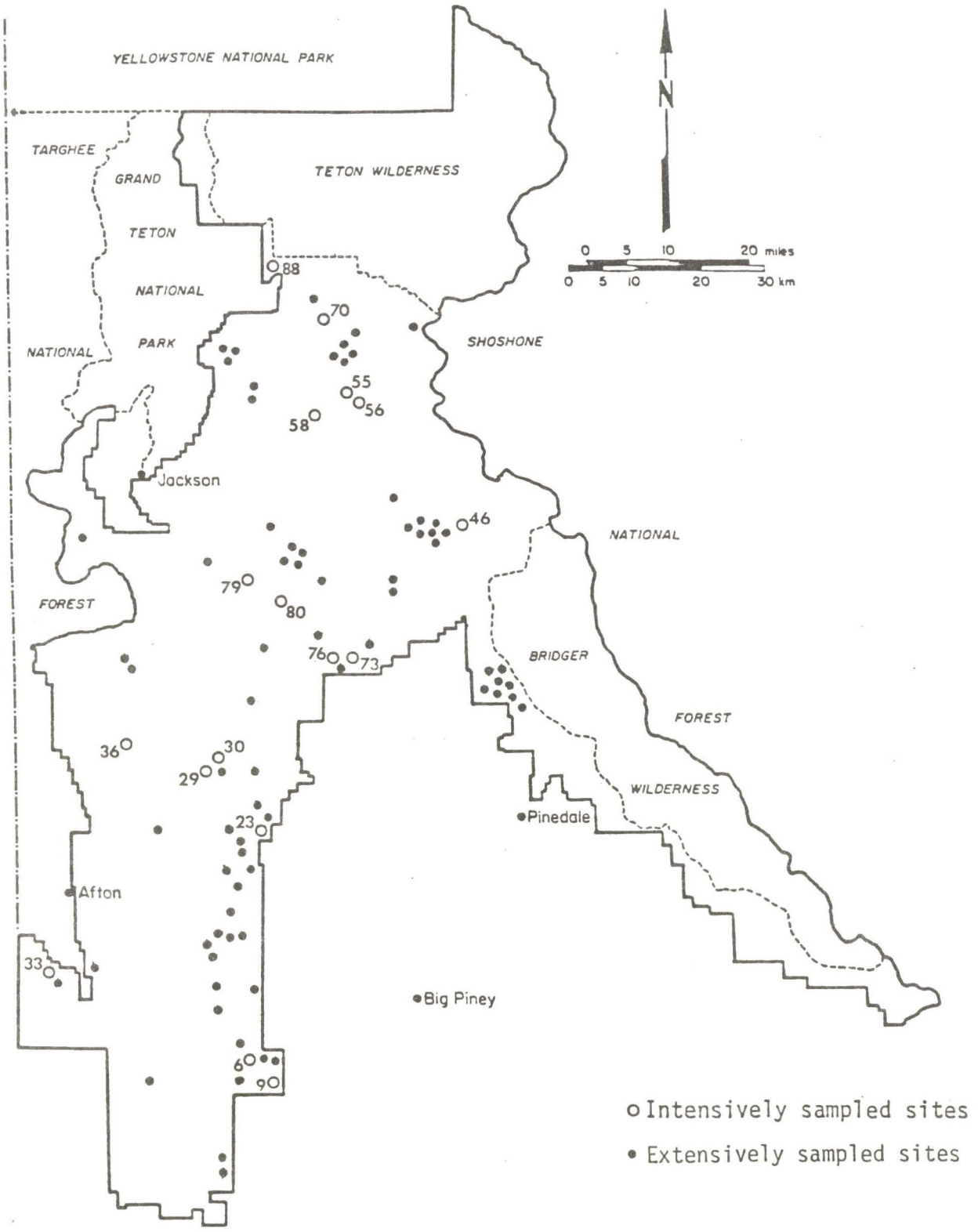
This extensive survey provided data on the location, general characteristics/conditions and a photographic record of the array of sites present, which may have value for future use by the Forest Service. It also laid the foundation for the subsequent intensive phase of the study.

Intensive Analysis

Site Selection

Field notes and photos taken of the of the 83 sites surveyed during 1981 were examined to determine which sites would be best to intensively sample. Sites which had been disturbed since abandonment were eliminated first. The next criterion for site selection concerned adjacent native vegetation. In many cases, adjacent vegetation was a mosaic of community types on varied exposures, making it difficult to estimate what type of vegetation existed on the disturbed site prior to drilling. Any site which was questionable for

FIGURE 4. Locations of intensively and extensively sampled sites.



this reason was excluded. The remaining sites were then grouped according to composition of surrounding native vegetation. Sites were classified into one of three broad vegetation types - sagebrush/grass, coniferous and aspen. Sites within these types were then subdivided into age classes consisting of 1-5, 5-11, 11-20, 20-30 and over 30 years since abandonment. Sites within each age class were then separated according to whether or not they had been seeded at the time of abandonment.

Seventeen sites were selected for sampling which met the above criteria and best represented the variety of environmental and physical factors to be studied. These included nine sites located within sagebrush/grass community types, ranging in age since abandonment from 3 to 33 years. The remaining eight sites were surrounded by coniferous vegetation and also ranged in age from 3 to 33 years. No sites were sampled within the aspen vegetation type because it contained only two sites suitable for sampling. It was felt that such a small number would not provide enough information to detect successional trends within this vegetation type.

Site Sampling

Rationale/Experimental Design

In this study, a static approach (Austin, 1977) was used to collect vegetation and soils data related to plant community development on abandoned oil and gas drilling sites. This method involves the determination of trends from data collected at one point in time on sites of varying "ages."

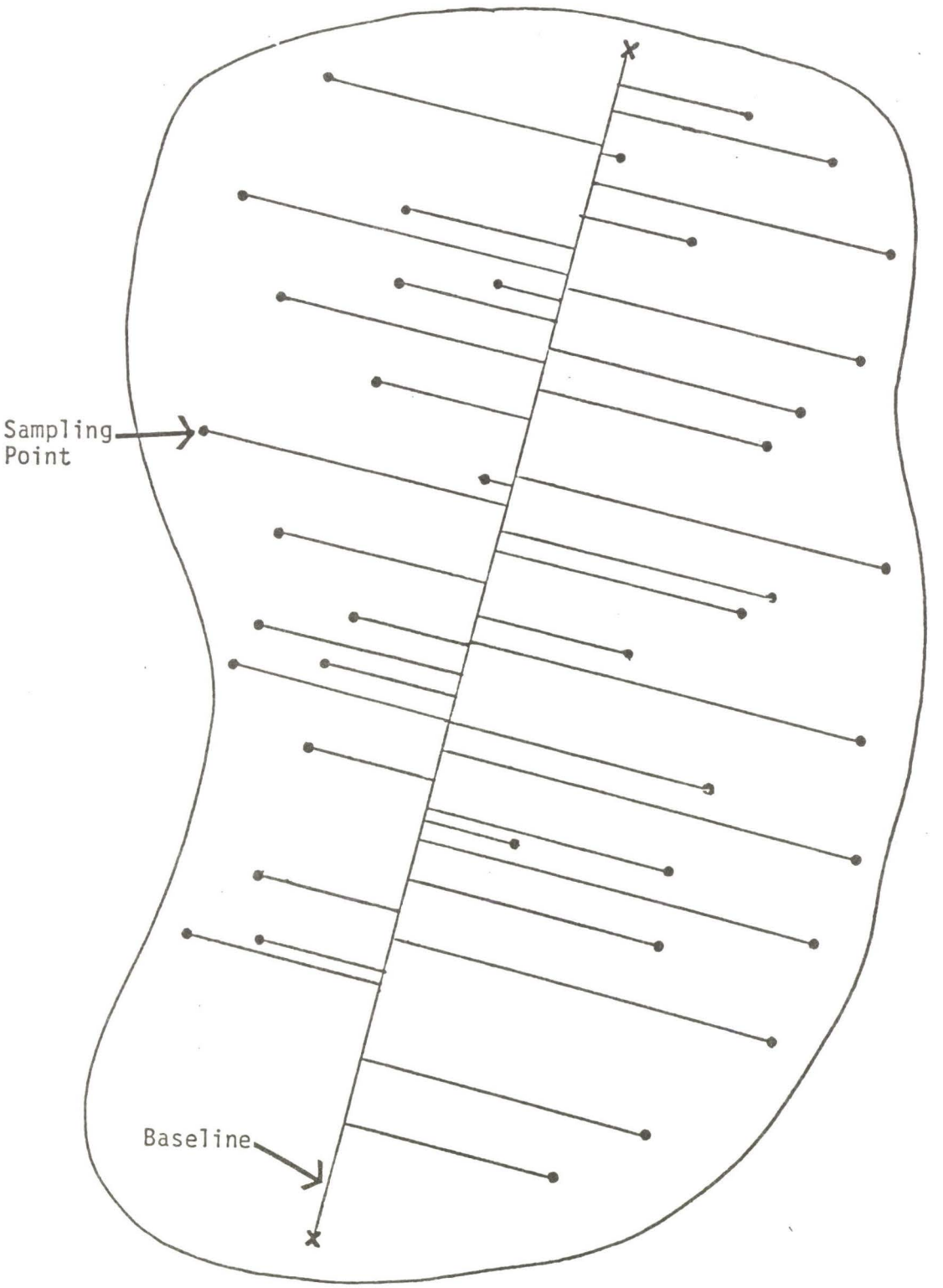
Soil and vegetation sampling involved conducting the same procedures on both the disturbed site and on a designated portion of the surrounding undisturbed area. Native undisturbed plant communities adjacent to disturbances were considered representative of the level of plant community development expected under the natural conditions and existent management of the area. If the objective of reclamation is to return a disturbed site to its original condition, adjacent undisturbed communities provide an approximate "goal" (Brown and Johnston, 1980). Therefore, data from undisturbed areas were utilized in a comparative sense with those from drill sites to evaluate successional status and/or differences on the drill sites.

Vegetation Sampling Methods

Through preliminary sampling and testing for adequate sample size (Cook and Bonham, 1977), 40 was determined to be an optimal sample size for vegetation measurements. A similar procedure was used to locate forty sample points on the drill site and a designated native sampling area. This entailed stretching a baseline tape along the length of the disturbed zone and approximating this distance as much as was practical within the undisturbed area to be sampled. Forty numbers were then randomly selected to represent distances along the baseline tape. At each of these locations, another random number was selected and this distance projected perpendicularly from the tape. These final positions were designated as independent sampling points (Fig. 5).

Intensive sampling was initiated in late May, 1982 and was completed by August, 1982. Data collection occurred once at each site.

FIGURE 5. Diagram of method used to designate 40 random sampling points on each disturbed and native site.



Cover

Canopy cover comprised the major type of vegetation data collected at each sampling point. The quadrat method of Daubenmire (1959) was used. Daubenmire's cover classes were modified (Bramble-Brodahl, 1978) to allow more accurate recording of small percentages of cover. The eight cover classes used, with their respective ranges and midpoints, were as follows:

Class	Range (%)	Midpoint (%)
1	.1-1	.5
2	1.1-5	3.0
3	5.1-15	10.0
4	15.1-25	20.0
5	25.1-50	37.5
6	50.1-75	62.5
7	75.1-95	85.0
8	95.1-100	97.5

One 30 x 83 cm quadrat ($0.25m^2$) was located at each sampling point. Canopy cover of all individual plant species[1] (except large trees) subtending the quadrat was estimated using cover classes. Canopy cover of tree species was estimated for only those branches subtending the quadrat 140 cm or less off the ground. Independent (non-summed) canopy cover determinations were also made for the following species groupings:

1. Total vegetation
2. Total perennial grasses
3. Total annual grasses
4. Total leguminous forbs
5. Total perennial non-leguminous forbs
6. Total annual non-leguminous forbs
7. Total shrubs and tree seedlings

In addition to vegetation canopy cover, ground cover was also estimated in each frame in four categories:

1. Bare ground (rock plus soil)
2. Plant litter
3. Moss/lichen
4. Total basal stem cover of live plants

Ground cover of three size classes of surface rock (< 2 cm, 2-30 and > 30 cm diameter) was also independently estimated.

Canopy cover data were utilized to determine percent species composition, diversity and similarity indices, and species richness among sites.

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[1]Taxonomic nomenclature for this study follows Hitchock, C.L. and A. Cronquist, 1973. Flora of the Pacific Northwest. Univ. of Washington Press, Seattle, WA.

Canopy cover of shrubs was also measured using the line intercept method (Phillips, 1959). A 5.0 m sampling line was projected to the north from each sampling point. The portion of the line subtended by shrubs was recorded by species. However, these data were not used in final analysis because variability with this method was greater than that resulting from quadrat shrub canopy cover estimates.

Shrub Density

Utilizing the same 5.0 m tape from the line intercept procedure, a 1 m width was projected along the eastern side of the tape and shrub density was measured within this 5.0 m^2 area. Shrubs rooted within this area were counted by species and segregated into five height classes; < 5 cm, 5-15cm, 15-60 cm, 60-140 cm and > 140 cm. This facilitated a density estimate by species as well as a relative comparison of shrub maturity.

Tree Basal Area and Density

On sites containing tree species, a plotless sampling technique (Avery, 1967) was used at each sample point to estimate tree basal area and density by species. This method required the use of a basal area factor gauge through which trees were determined to be in or out of the sampling area. Tallied trees were measured for diameter at breast height (1.4 m) (DBH). Trees were recorded by species and placed within one of 15 designated DBH classes. These classes were divided into increments of 5 cm, ranging from less than 5 cm to greater than 76.2 cm.

Soil Sampling Methods

Soils were characterized at each site by taking samples at varying depths from one pit on the drill site and one on the adjacent undisturbed area. Soil depths sampled were 0-5 cm, 6-10 cm, 11-20 cm, 21-30 cm and 31-50 cm. Soils collected at each depth were analyzed[1,2] for the following parameters:

1. Texture (hydrometer)
2. PO_4 (ppm) (sodium bicarbonate extraction)
3. Organic matter (%) (Walkley Black)[3]
4. pH (paste)
5. Cation Exchange Capacity (meq/100g) (sodium extraction)
6. Sodium Absorption Ratio (saturation extract)

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[1]Soils analysis conducted by the Soils Testing Lab, Univ. of Wyoming, Laramie, WY.

[2]All procedures used in soils analysis (with exception of organic matter) are explained in Black, C.A. (ed.). 1965. Methods of Soils Analysis. Amer. Soc. Agron. Series No. 9, Madison, WI.

[3]Procedure follows Greweling, T. and M. Peech. 1965. Chemical Soil Tests. Cornell Univ. Agr. Exp. Sta. Bull. 960, Ithaca, New York.

7. Electrical Conductivity (mmhos) (saturation extract)
8. K (meq/100g) (ammonium acetate)
9. Exchangeable Ca-Mg-Na (meq/100g) (ammonium acetate)

At each pit, total percent of coarse fragments was estimated for every layer. Identifiable soil horizons were noted and respective depths measured, as were effective rooting depths at each pit. Any other distinguishing features were also recorded.

Bulk density was determined by extracting a soil clod from every layer and coating each with saran resin to facilitate handling. Total porosity of each sample was determined by weighing in both air and water. Volume was then calculated according to the amount of water displaced and the bulk density subsequently calculated by dividing the weight of the soil clod by its volume (Hillel, 1980).

Supplemental Data

All sites displayed evidence of use by either wildlife or domestic livestock. Relative use was estimated on all areas sampled utilizing the Forest Service's method of fecal counts. A circular plot with an 3.6 m radius was superimposed over ten sampling points and all droppings within the plot were recorded according to animal species. This information provided a means of comparing relative use by specific species on the disturbed and adjacent undisturbed areas, and between sites and various vegetation communities sampled.

Numerous photographs were taken of every site sampled. These included a photo of each drill site taken from a staked and recorded position to serve as a reference photo for future evaluations of vegetation changes.

Methods of Data Analysis

All data were organized into a tabular format to facilitate comparisons between disturbed and adjacent undisturbed communities. A similarity index designed by Spatz (Mueller-Dombois and Ellenburg, 1974) based on individual species cover data was used to determine relative similarity of vegetation between disturbed and undisturbed areas. This method reflects both quantitative and qualitative differences of compared communities and is also sensitive to species with small values which are often overlooked in other indices. The Shannon-Weiner diversity index was also used for further description of communities (Pielou, 1975) (see Appendix B for explanation of these indices).

Two sample independent T-tests were utilized to detect significant differences in vegetation parameters and fecal counts between drill sites and adjacent native areas. All tests were conducted using an alpha level of .05 percent.

Results of soils analyses from each disturbed and native zone were grouped and averaged within each plant community type sampled (sagebrush or coniferous). These results were then (paired) T-tested to identify any significant differences between disturbed and native soil parameters within either of the types.

Simple and multiple linear regression was also used to determine any significant correlations/trends between edapic, biotic or abiotic factors and time.

RESULTS AND DISCUSSION

Extensive Survey

At the time of study initiation (May, 1981), there were 91 known abandoned drill sites in the Forest. Eighty-three of these were located (see Fig. 4) and surveyed during the summer of 1981. The extensive survey data were primarily qualitative. They were collected to provide general information on site location, condition and surrounding environment. These data provided the basis for selection of sites for subsequent intensive analysis, and were not otherwise used. Therefore, extensive survey results are summarized and presented in Appendix C, and will not be discussed further within the body of this report.

Intensive Analysis

Individual Site Results

Based upon results of the extensive survey, 17 sites were selected for intensive analysis. Nine of these were located within sagebrush plant associations, and eight within coniferous plant associations. Appendix D contains detailed information on location and physical characteristics, and presents summaries of all vegetation and soils data for each site.

All individual site data collected on disturbed areas and their undisturbed counterparts clearly indicated that exploratory drilling does drastically alter vegetation and soils. However, identification of general relationships and trends among sites was made difficult by varying degrees of uniqueness among sites in terms of biological, physical and treatment/land use history characteristics. Despite these difficulties, it was considered essential to conduct a grouped site analysis. The data of Appendix D thus comprise the basis for the following section, which synthesizes and interprets general patterns of data among individual sites relative to stated study objectives.

Trends Among Sites

Soils

Several important soil parameters were grouped and averaged among sites within the sagebrush and coniferous vegetation types. These data were subjected to paired T-tests to detect significant differences between disturbed and native soils (Table 1). Selected parameters were also examined using linear regression analysis to detect any trends among native/disturbed pairs with increasing age since abandonment. The significant linear equations resulting from these analyses are presented in Appendix E.

Percent Coarse Fragments

Mean percent coarse fragments in the upper 20 cm of soil was found to be significantly greater on disturbed than on native areas for sagebrush sites. Below this depth, there were no significant differences between native and disturbed soils, although coarse fragment percent was generally greater in disturbed soil profiles. For coniferous sites, percent coarse fragments was

TABLE 1. Comparison of mean disturbed/native soil characteristics among sites within the sagebrush and coniferous vegetation types.

Parameter	Depth[1]	SAGEBRUSH			CONIFEROUS		
		Disturbed Site	Native Site	Significance of Difference (at α .01-.20)	Disturbed Site	Native Site	Significance of Difference (at α .01-.20)
% Coarse Fragments	1	18	5	.05	18	7	.01
	2	24	7	.01	18	8	.05
	3	32	17	.05	22	9	.05
	4	32	22	none	24	13	.20
	5	34	31	none	24	22	none
Bulk Density (g/cm^3)	1	1.54	1.21	.01	1.52	1.23	.01
	2	1.54	1.28	.10	1.72	1.33	.01
	3	1.65	1.35	.10	1.81	1.40	.01
	4	1.74	1.58	.20	1.79	1.48	.05
	5	1.75	1.53	.01	1.85	1.66	.01
pH	1	6.9	6.5	.10	7.0	5.8	.01
	2	7.1	6.6	.05	7.0	5.6	.01
	3	7.3	6.7	.05	6.9	5.6	.01
	4	7.4	6.6	.01	6.9	5.7	.01
	5	7.4	6.7	.05	7.0	5.8	.01
% Organic Matter	1	4.7	9.2	.05	3.5	7.4	.05
	2	4.6	5.8	none	2.8	6.3	.05
	3	3.5	3.9	none	3.0	3.0	none
	4	2.8	3.0	none	1.7	2.1	none
	5	2.1	2.5	none	1.8	1.7	none
Available Phosphorus (ppm)	1	27.0	32.2	none	22.0	20.1	none
	2	24.4	29.4	none	16.9	21.6	none
	3	23.0	32.1	.20	16.2	28.8	.10
	4	27.0	27.8	none	16.1	25.0	none
	5	19.2	19.5	none	14.4	23.1	.10
Exchangable Potassium (meg/100g)	1	.86	1.07	.20	.64	.72	none
	2	.71	.96	.10	.56	.61	none
	3	.50	.83	.10	.44	.48	none
	4	.44	.72	.10	.38	.39	none
	5	.43	.57	.20	.40	.37	none
% Clay	1	29	23	none	29	22	.05
	2	25	25	none	30	25	.10
	3	22	24	none	31	27	.20
	4	24	23	none	31	29	none
	5	24	24	none	32	27	none
Effective Rooting Depth (cm)	N/A	38	48	.05	42	51	.10

[1] 1 = 0-5 cm; 2 = 6-10 cm; 3 = 11-20 cm; 4 = 21-30 cm; 5 = 31-50 cm

greater in disturbed soils at the four uppermost depths sampled. No significant difference was exhibited within the 31-50 cm zone.

Bulk Density

Bulk densities were significantly higher on disturbed than on native soils in both sagebrush and coniferous vegetation types at all depths sampled (Table 1). It might be expected that differences in bulk density between disturbed and native sites would lessen over time. However, no such trend was significant nor evident from regression analyses over the 33 year frame investigated.

Effective Rooting Depth

Effective rooting depth was found to be significantly shallower in disturbed than in native soils within both the sagebrush and coniferous vegetation types (Table 1). This may be attributable to the higher coarse fragment content and bulk density of most disturbed soils, both of which could impede root elongation.

Soil pH

Soil pH values were significantly higher in disturbed than in native soils in both vegetation types at all depths (Table 1). Degree of significance varied with sample depth for sagebrush sites. Average soil pH within this vegetation type ranged from 6.9 to 7.4 in disturbed soils, and from 6.5 to 6.7 in native soils.

A wider disparity in pH existed between disturbed and native soils within the coniferous vegetation type. Native soil pH ranged from 5.6 to 5.8, which was considerably more acidic than the average pH of 7.0 for disturbed soils. Soil pH did not exhibit any trend with age since abandonment that would suggest disturbed soil pH to become more similar to native soil pH within the 33 year time frame studied.

Percent Organic Matter

Soil organic matter in the upper depths was significantly greater on native than on disturbed sites in both the sagebrush (0-5 cm depth) and the coniferous (0-10 cm depth) vegetation types. These differences in organic matter content did not diminish with time in the coniferous type. However, disturbed:native soil organic matter content ratios within the sagebrush type at the 0-5 cm depth did show a statistically significant linear increase (α of .2, Appendix E), suggesting that disturbed sagebrush site soil organic matter content will increase toward native levels with time. This linear regression analysis estimated 27 years as necessary for disturbed site organic matter content to equal that of adjacent native soils. Thus, it may take decades for organic matter content in disturbed sagebrush type soils to equal that of native soils. The lack of apparent or significant trends over 33 years within the coniferous vegetation type would suggest an even longer time frame for organic matter content equalization in that life zone.

Available Phosphorus

Mean available phosphorus concentrations were found significantly different between disturbed and native soils at only one of the depths (11-20 cm) sampled in the sagebrush type. Phosphorus content was greater in the native soil within this depth zone. In general, available phosphorus was found to be lower in disturbed than in native soils on the more recently disturbed sites. Linear regression analysis indicated a positive correlation (α of .2, Appendix E) between disturbed:native soil phosphorus ratios and increasing years since abandonment in the 0-5 cm depth zone, and estimated that it would take 19 years for disturbed soil available phosphorus concentrations to equal those of native soils.

Mean concentrations of phosphorus in disturbed and native coniferous type soils were found to be significantly different only at the 11-20 cm and 31-50 cm depths. At these depths, phosphorus was greater in the native soils. In contrast to sagebrush sites, no apparent trend in disturbed:native soil phosphorus ratios with time occurred among coniferous sites.

Exchangeable Potassium

Within the sagebrush type, mean concentrations of potassium were found to be significantly higher in native than in disturbed soils at all depths (Table 1). However, no significant trend of increasing similarity between disturbed and native soils with increasing years since abandonment was detected for potassium.

No significant differences were detected in mean potassium between disturbed and native soils at any soil depth in the coniferous type. However, results of linear regression analysis did indicate a downward trend in potassium concentration ratios within the 6-30 cm depth across all eight sites. Potassium was greater in disturbed soils at the 6-30 cm depth on the three most recently abandoned sites. Older sites exhibited either similar concentrations between disturbed and native soils or higher amounts in native soils. This suggests that soil potassium in the coniferous zone may sometimes be temporarily increased by drilling disturbance. This may be the result of drilling fluids characteristically containing forms of potassium i.e., potassium chloride or potassium dichromate, being mixed into regraded soil (Miller et al., 1980). This relationship resulted in a negative correlation between years since abandonment and disturbed:native soil potassium ratios. The linear equation (Appendix E) estimated that 17 years would be needed for potassium to become similar in disturbed and native soils.

Percent Clay

Soil textures in the sagebrush type were not altered as a result of drilling, as illustrated by the lack of statistically significant differences in percent clay between disturbed and native soils. However, percent clay was significantly greater in the upper 20 cm of disturbed soils within the coniferous type (Table 1). Despite these differences, soil textural designations for the 0-20 cm depths were generally the same for each disturbed/native pair (Appendix D).

Additional Parameters

Cation exchange capacity was generally unchanged as a result of drilling, although variability among specific sites occurred. All soils sampled showed low sodium adsorption ratios, electrical conductivities and associated levels of exchangeable cations, indicating no differences and/or problems with salinity or sodicity in the soils studied.

Vegetation

Total Cover

Total vegetation cover was significantly greater on nearly every native area sampled (Table 2). No consistent pattern of increased similarity in total cover between disturbed and native sites with increasing age since abandonment was observed. Instead, disturbed/native total cover relationships were very site specific, with several more recently abandoned sites exhibiting less difference in total cover than older sites (Table 2).

Plant Class Cover

Perennial grasses/grasslikes were generally the dominant plant form on seeded disturbed sites, and also usually exhibited significantly greater cover on disturbed than on native sites (Table 2). Grass cover on seeded sagebrush and coniferous disturbed sites was initially greater than on native sites, with this relationship decreasing with time (Fig. 6). Regression analysis of seeded grass cover ratios (between disturbed and native sites) vs. time suggested that grass cover on disturbed sites will eventually decline to equal or lower levels than those of native sites. The time necessary for this was estimated to be 10 years in the sagebrush zone and 17.5 years in the coniferous zone (α of .1 for both, Appendix E).

When a disturbed site is seeded with grasses, these species become the colonizing growth form, pre-empting annual forb invasion and far surpassing the natural rate of grass reestablishment (Moore et al., 1977). Perennial grass cover was lower than that on native sagebrush sites on all but one of the unseeded disturbed sites, where grass recolonization occurred naturally (Fig. 6). The exception to this was Site 88. Bromus inermis, an introduced perennial grass, dominated Site 88. This site was not seeded at the time of abandonment. The bromegrass was apparently introduced by some other means, giving the site characteristics of a reseeded site. Within the coniferous vegetation type, the nonseeded disturbed sites exhibited significantly greater grass cover than that in the native understory. This is attributable to the unshaded opening created by drilling disturbance, allowing the establishment of grass species unable to survive in the shaded native understory community.

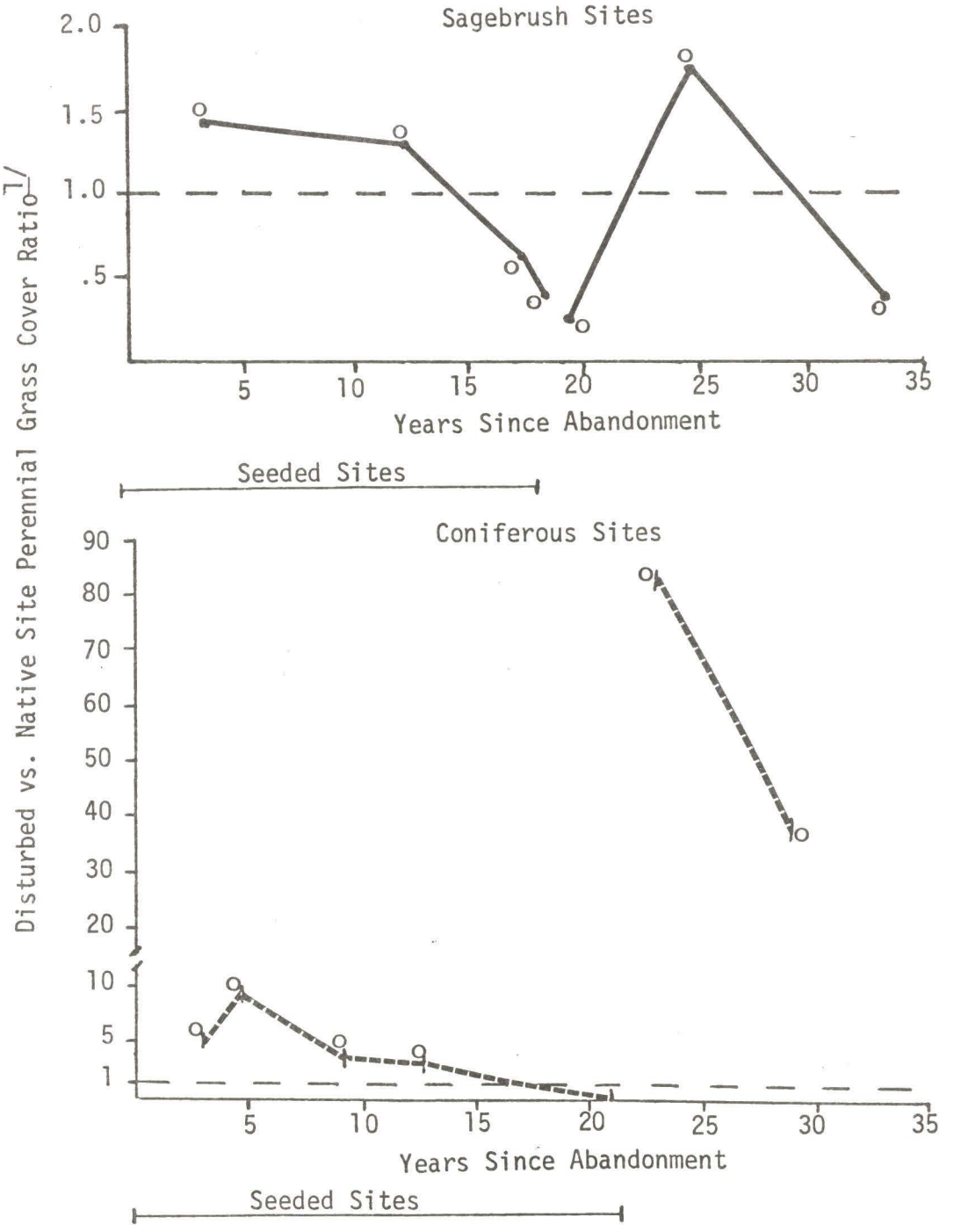
Perennial forb cover was generally lower on disturbed than on native sites (Table 2). This was most pronounced on the more recently abandoned, seeded sites in both the sagebrush and coniferous types (Fig. 7). Linear regression analysis (Appendix E) indicated that disturbed:native forb cover ratios did tend to increase with time. Analysis of seeded sites estimated that approximately 24 years were required for disturbed and native site forb cover to equalize in the sagebrush vegetation type, in contrast to 15 years

TABLE 2. Mean estimated plant class[1] canopy cover (%) for each site sampled.

	Total Vegetation		Perennial Grasses and Grasslikes		Perennial Forb		Annual Forb		Leguminous Forb		Shrubs (and/or) Tree Seedlings	
	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.
A. SAGEBRUSH SITES												
Site 58	18.2[b2/]	49.0[a]	15.2[a]	13.2[a]	1.2[b]	27.4[a]	.5[b]	2.4[a]	1.4[a]	1.7[a]	.2[b]	8.5[a]
Site 30	43.2[b]	64.4[a]	35.6[a]	20.2[b]	3.6[b]	27.3[a]	4.1	0	.5[b]	1.4[a]	.1[b]	27.9[a]
Site 29	34.8[b]	63.1[a]	30.2[a]	23.4[b]	3.9[b]	32.1[a]	1.9[a]	.3[b]	T[b3/]	1.0[a]	0	21.4
Site 46	55.1[b]	66.0[a]	15.3[b]	23.7[a]	32.8[a]	32.4[a]	1.3[a]	.1[b]	1.3[a]	2.0[a]	6.9[b]	15.9[a]
Site 73	29.4[b]	47.8[a]	3.7[b]	9.9[a]	4.6[b]	7.2[a]	1.0[b]	2.6[a]	3.4[a]	4.1[a]	16.7[b]	28.4[a]
Site 76	23.1[b]	50.5[a]	5.0[b]	19.8[a]	16.3[a]	9.1[b]	1.5[a]	1.5[a]	.2[b]	1.9[a]	.7[b]	20.7[a]
Site 88	48.4[b]	61.8[a]	34.8[a]	20.4[b]	6.2[b]	15.4[a]	0	.6	1.6[a]	1.2[a]	6.5[b]	41.8[a]
Site 33	20.5[b]	66.0[a]	5.6[b]	14.8[a]	7.7[b]	31.3[a]	.5[b]	4.8[a]	.2[b]	3.8[a]	9.1[b]	23.0[a]
MEAN	34.1	58.6	18.2	18.2	9.5	22.8	1.4	1.5	1.1	2.1	5.0	23.4
B. CONIFEROUS SITES												
Site 9	19.0[a]	25.7[a]	16.5[a]	3.1[b]	.5[b]	13.6[a]	2.1[a]	.2[b]	T [b]	4.2[a]	.1[b]	7.0[a]
Site 36	43.4[a]	44.5[a]	37.4[a]	4.0[b]	2.2[b]	28.8[a]	3.0[a]	.2[b]	1.0[a]	2.3[a]	.3[b]	13.2[a]
Site 6	15.0[b]	26.3[a]	11.8[a]	3.8[b]	2.5[b]	9.8[a]	1.3[a]	T[b]	.3[b]	7.0[a]	0	8.6
Site 80	30.4[b]	51.7[a]	15.8[a]	5.3[b]	4.4[b]	35.5[a]	6.8[a]	2.9[b]	2.5[b]	6.1[a]	0	5.2
Site 23	36.0[a]	23.1[b]	13.2	0	18.4[a]	9.9[b]	.1	0	2.3	0	3.4[b]	15.1[a]
Site 56	31.6[b]	81.1[a]	8.2[a]	.1[b]	11.8[b]	22.8[a]	.4	0	9.7[a]	2.3[b]	1.4[b]	40.1[a]
Site 55	46.5[a]	50.1[a]	11.4[a]	.3[b]	18.5[a]	19.3[a]	.3	0	12.2[a]	1.2[b]	2.5[b]	28.5[a]
MEAN	31.7	43.2	16.3	2.4	8.3	20.0	2.0	.5	4	3.3	1.1	17.0

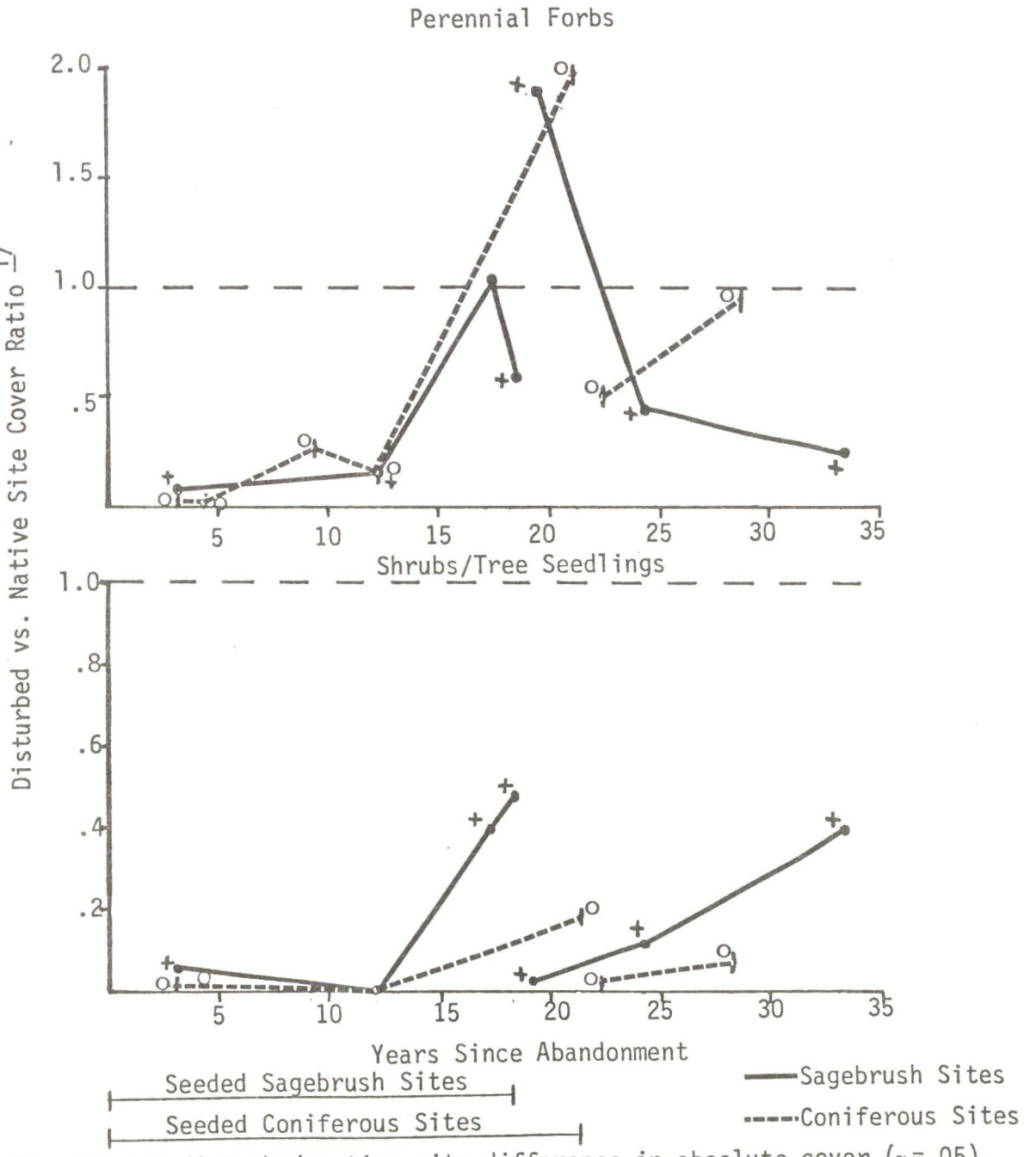
1/ Independently estimated; i.e. not summed parameters.
2/ Values between disturbed-native site pairs followed by the same letter are not significantly different at the .05 level (t-test).
3/ T = trace; i.e., less than 0.1 percent.

FIGURE 6. Sagebrush and coniferous sites: perennial grass canopy on disturbed sites relative to that on native sites[1] (significant linear equations are listed in Appendix E).



1/ Disturbed Site Value ÷ Native Site Value
oSignificant disturbed-native site difference in absolute cover

FIGURE 7. Sagebrush and coniferous sites: perennial forb and shrub/tree seedling canopy cover on disturbed sites relative to that on native sites[1] (significant linear equations are listed in Appendix E).



estimated in the coniferous type (α of .1 and .05, respectively). Regression analysis of all sites (i.e., seeded plus non-seeded) did not yield a significant correlation in the sagebrush type, but did result in a positive correlation in the coniferous type, with 24 years being predicted as necessary for forb recovery (α of .1). These analyses suggested two things: 1) rates of forb reestablishment tended to be more rapid on disturbed coniferous sites than on disturbed sagebrush sites, and 2) applying reclamation practices in conjunction with seeding tended to accelerate forb reestablishment on disturbed coniferous sites.

Shrub and tree[1] seedling cover on disturbed sites was consistently significantly lower than that sampled on adjacent native sites (Table 2). Shrubs and tree seedlings were virtually non-existent or in very low numbers on sites which had been abandoned within the last 12 years. Cover and density (Appendix D) of such species on older sites were still significantly lower than on adjacent native areas. Tree seedlings were observed only on the three oldest sites within the coniferous type, ranging in age from 21 to 28 years since abandonment.

Figure 7 illustrates the tendency for shrub/tree seedling cover on disturbed sites to become more similar to that of native sites with increasing age since abandonment. Results of linear regression analysis substantiated this relationship, with all linear equations (Appendix E) exhibiting positive correlations between time and increasing similarity of disturbed:native site ratios. Within the sagebrush type, analysis of all sites (seeded plus non-seeded) estimated 78 years for disturbed and native site shrub cover equalization (α of .2). Analysis of seeded sites only within this type suggested that grass seeding accelerated shrub reestablishment, with a span of 35 years (α of .1) being necessary for shrub cover on disturbed and adjacent native sites to become equal. Regression analysis of all coniferous disturbances combined suggested far more time (i.e., 225 years) would be necessary in this type for disturbed site shrub/tree seedling cover to equal that of its predisturbance condition (α of .2). Analysis of seeded coniferous sites only estimated approximately 107 years for the same equalization (α of .1), indicating the benefits of seeding. These regression-based estimates, in relative terms, suggest the longer amount of time needed for shrub/tree reestablishment, as opposed to other plant classes, and the possible effects of seeding with grasses. They also indicate the differences in recovery time that can be expected between sagebrush and coniferous zone disturbances.

Native coniferous sites exhibited total densities of larger trees (i.e., > 5.1 cm DBH and 140 cm height) ranging from 300 to 5100 stems/ha (Appendix D). Such size classes were completely absent from drill sites, further emphasizing the vegetational dissimilarity of native and disturbed plant communities within the coniferous type.

No general trends or relationships were apparent in either occurrence or cover of annual and leguminous forb plant classes on disturbed vs. native sites. Occurrence and growth of such species appeared to be site specific, the only consistent characteristic being low composition in all plant communities sampled (Table 2 and Appendix D).

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[1] Less than 140 cm in height.

Similarity Indices and Common Species

A characteristic of most sites studied was the generally low number of plant species common to both disturbed and native plant communities (Appendix F). The proportion of common species to all species present (in both native and disturbed zones) was low at all sites (Fig. 8). This is also reflected in the range and pattern of disturbed-native vegetation similarity indices calculated among sites (Fig. 9). All indices were very low, ranging from .6 to 10.6 percent. These values reflect both the low number of common species and the disproportionality of cover contributed by these species in each disturbed and native community.

Disturbed and native sites in the sagebrush type tended to exhibit increased similarity and associated numbers of common species as age since abandonment increased (Figs. 8 and 9). This trend was substantiated by linear regression analysis (Appendix E), which indicated a positive correlation between time and similarity index values. The linear equation developed by analyzing all sagebrush sites combined estimated that 435 years would be needed before disturbed communities would attain 100 percent similarity to their native counterparts (α of .2). Regression analysis of seeded sites estimated 213 years for achievement of 100 percent similarity between disturbed and native communities (α of .2), suggesting that seeding sagebrush disturbances accelerated community development.

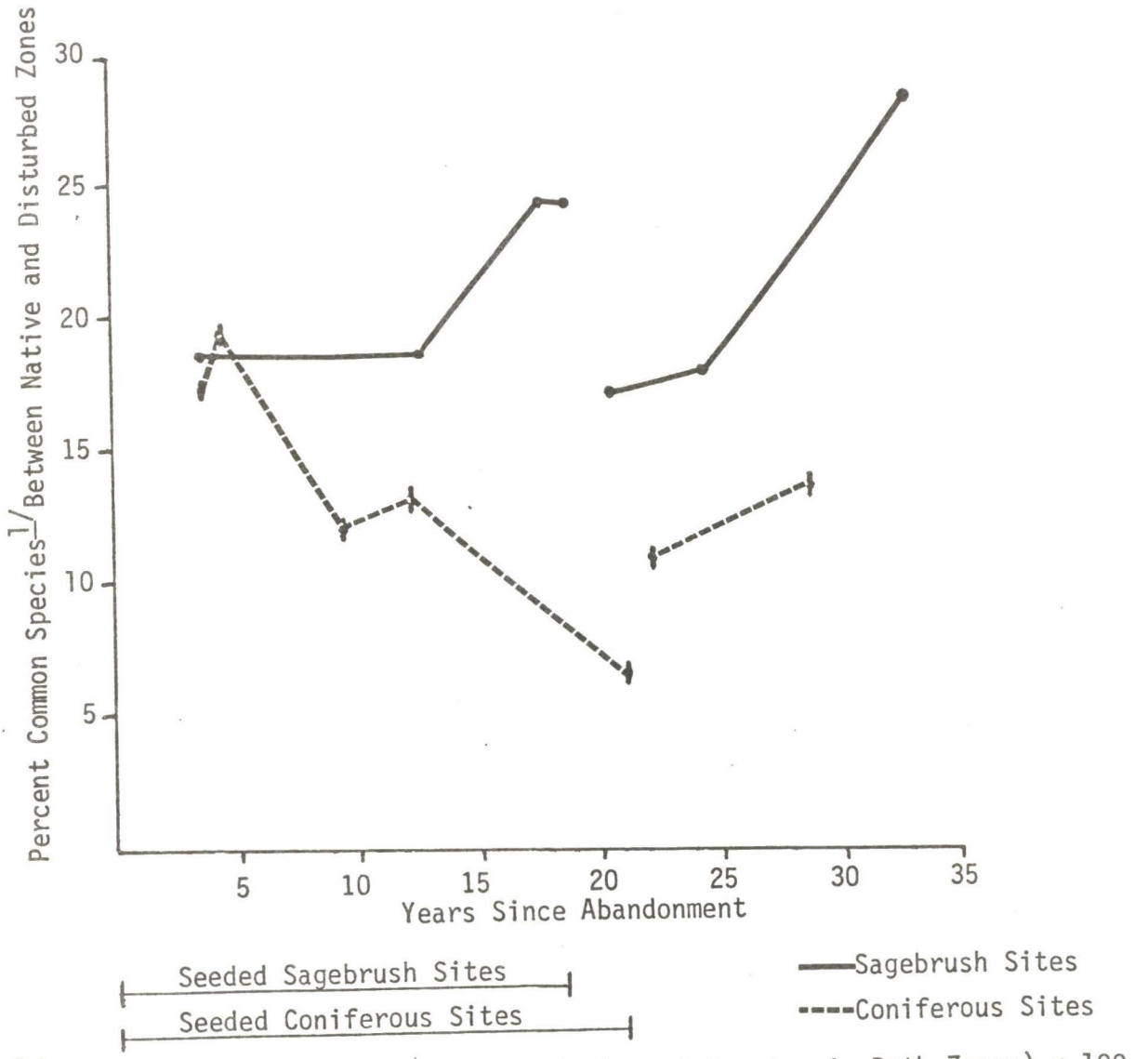
These and most of the preceding regression-based estimates have value primarily in a relative sense, due to the fact that predictions have been extrapolated beyond the time frame offered by this study. It must also be recognized that the regression method used assumes a linear relationship between time and successional development when theories and studies have suggested that it is actually a curvilinear relationship (Connell, 1978; Odum, 1969; Whittaker, 1953), with diversity, richness and gross productivity leveling off or declining in a climax community.

The values and ranges of percent common species and similarity indices for disturbed/native sites in the coniferous type were generally lower than those for the sagebrush type. The similarity indices and common species percentages associated with seeded coniferous disturbances exhibited a downward trend over time (Figs. 8 and 9). Regression analysis of similarity indices for seeded coniferous sites resulted in a negative correlation between this parameter and time (α of .2). In contrast, the non-seeded, older coniferous type disturbed sites exhibited increased similarity and number of species common to disturbed and native sites. These relationships suggest that seeding introduced grasses on coniferous type disturbances could have a negative effect on recovery toward a pre-disturbance condition in terms of floristic similarity, whereas this same treatment applied to sagebrush type disturbances appeared to have a positive effect. Regression also predicted that disturbances in sagebrush communities will return to predisturbance conditions more rapidly than will coniferous type disturbances.

Diversity Indices and Species Richness

Calculated diversity indices were consistently higher on each native site within the sagebrush vegetation type (Fig. 10). Overall species richness was also usually greater on native sagebrush sites (Fig. 10 and Appendix F).

FIGURE 8. Sagebrush and coniferous sites: ratio of common species[1] to total number of species sampled on each native/disturbed pair.



1/ (Number of Common Species ÷ Total Number of Species in Both Zones) x 100

FIGURE 9. Sagebrush and coniferous sites: Spatz indices of similarity (Isp) between disturbed and native zones (significant linear equations are listed in Appendix E).

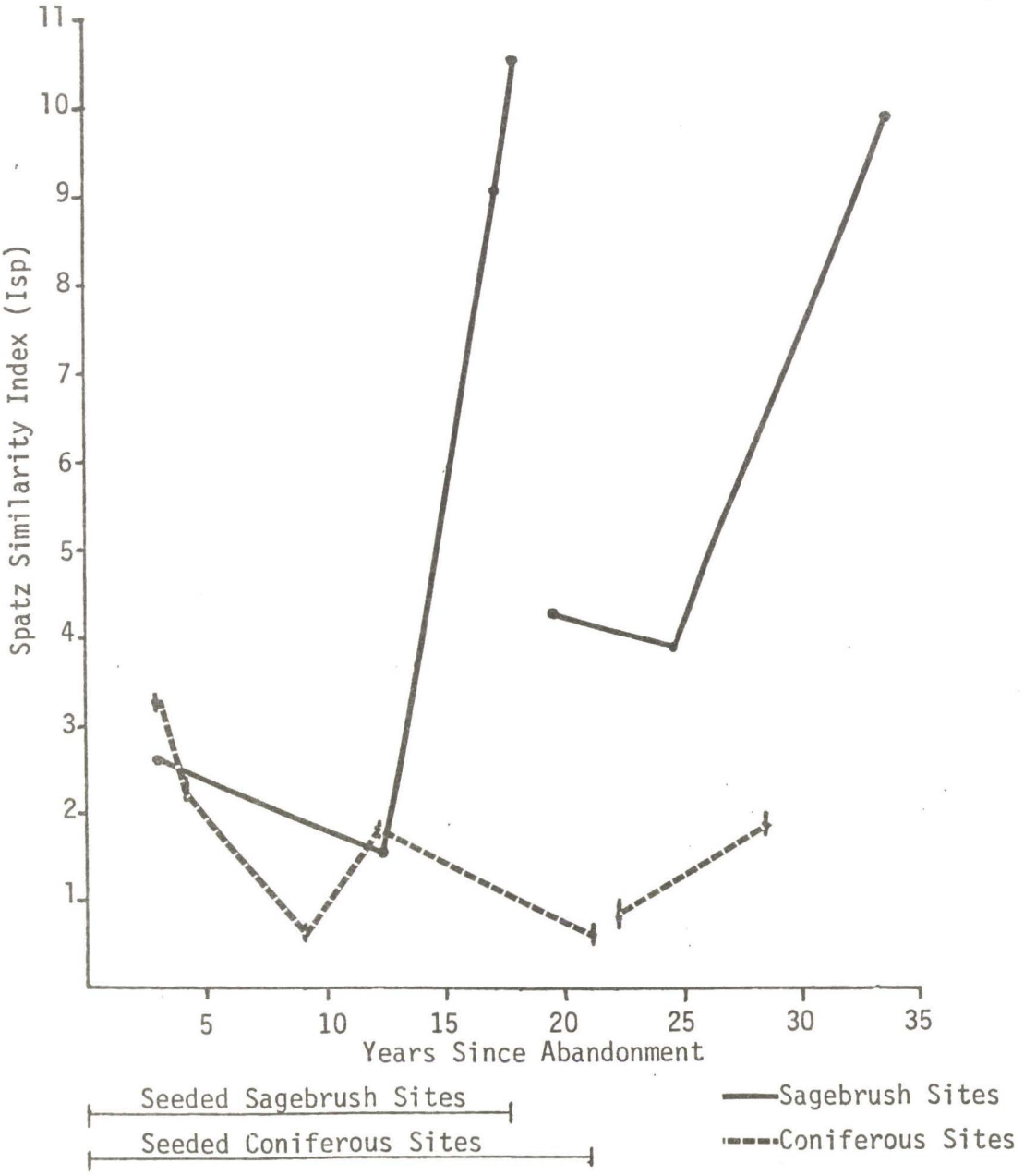
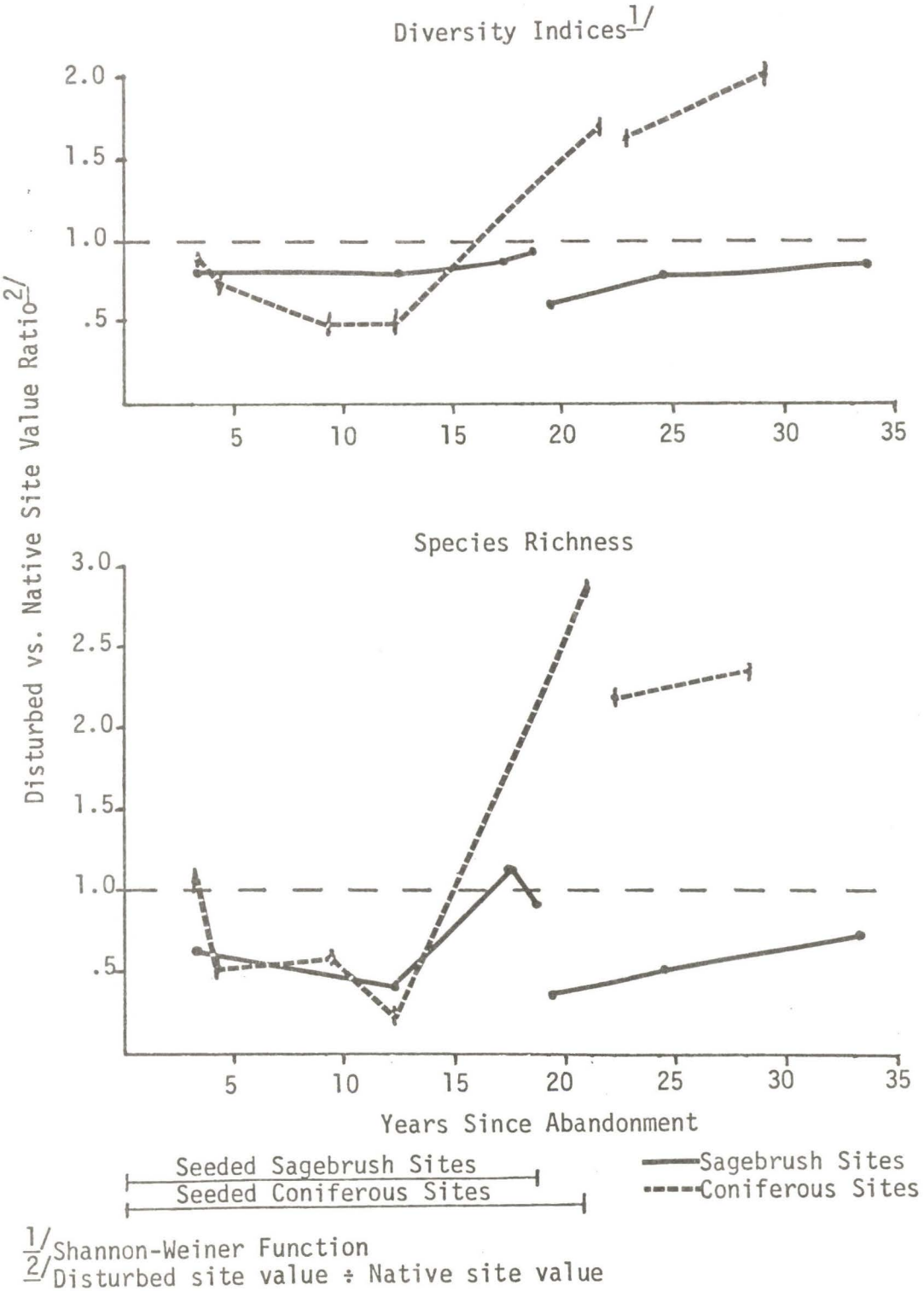


FIGURE 10. Sagebrush and coniferous sites: Diversity indices and species richness on disturbed sites relative to native sites[2] (significant linear equations are listed in Appendix E).



1/ Shannon-Weiner Function
2/ Disturbed site value ÷ Native site value

Disturbed:native site diversity index and richness ratios in the sagebrush type appeared to be relatively static, with little increase over time. No significant correlation with time was found for either parameter in linear regression analysis.

The coniferous type sites exhibited a more definite increasing trend in both diversity index and species richness disturbed:native ratios over time. Diversity indices and species numbers were generally lower on more recently disturbed sites than on adjacent native sites. This situation reversed after the 12 year point, with the three oldest disturbed sites exhibiting higher diversity indices and numbers of species than adjacent native sites. This trend was reflected in results of regression analysis (Appendix E), which yielded positive correlations for both parameters with time. "Indexed" diversity of disturbed sites was estimated to equal that of native sites after a period of 12 years (α of .05), while disturbed site species richness was estimated to equal that of native sites after 9 years of plant community development (α of .05).

Discretion is necessary when using diversity indices (and/or richness values) as indicators of site recovery to a predisturbance condition. The Shannon-Wiener (Shannon and Weaver, 1973) formula for calculating diversity is designed to characterize only one community at a time, since only those species restricted to a particular community contribute to the index value. The limitations of utilizing diversity indices for comparative purposes have often been alluded to (Chambers, 1983; Chambers and Brown, 1983), and include lack of consideration of species compositional differences among compared communities. The validity of the hypothesis of increasing diversity index values with increasing successional development has also recently been questioned for disturbed lands (e.g., Mackey and DePuit, 1984).

In light of these findings, it seems prudent to use a diversity index only in conjunction with other community descriptors (i.e., species/class cover and composition, similarity indices, etc.) to determine a site's level of successional advancement towards a predisturbance condition.

When both diversity and similarity indices among sites are considered, several important relationships become apparent. For sagebrush disturbances, diversity of disturbed communities was consistently lower than that of native communities. However, the number of species common to both sites and the resulting similarity indices tended to increase with increasing age since abandonment. Coniferous type sites exhibited diversity and similarity trends that were nearly opposite those of sagebrush type sites. Diversity indices and species richness within disturbed communities, although lower initially, tended to become greater than that observed on native sites with increasing years since abandonment. This is not unexpected in view of the fact that mature coniferous plant communities often support only a small variety of shade tolerant understory species (Antos and Shearer, 1981). Openings in coniferous plant communities offer an ideal environment for colonization of a large number of different, shade intolerant species. In contrast to diversity/richness patterns, similarity and number of common species decreased with age among seeded sites and increased only minimally among older non-seeded sites. This substantiates the fact that while a more diverse array of plant species have recolonized the disturbances, they were generally not the same species existing prior to disturbance.

These differences in relationships and trends between diversity and similarity and between vegetation types also have some more general implications for plant community succession. If it can be assumed that disturbed community similarity to a "climax" or higher seral stage community is a valid measure of disturbed community successional development, the inconsistent (and sometimes inverse) relationships between similarity and diversity index values demonstrated in this study would indicate that diversity does not always consistently increase with successional advancement. Indeed, data of this study within the coniferous vegetation type would suggest a modal pattern of diversity, with highest vegetation diversity during mid-seral stages.

Factors Influencing Current Status and Trends

Surrounding Vegetation

Results of vegetation sampling have indicated that disturbances within sagebrush-grass associations tend to develop toward predisturbance vegetation conditions more rapidly than disturbances within coniferous associations. This was demonstrated by both similarity index and common species data (Figs. 8 and 9). Disturbed/native sagebrush sites had larger percentages of common species than did coniferous sites. This was especially evident on older sites within each vegetation type. Similarity indices between disturbed and native areas were generally greater for sagebrush sites than for coniferous sites of similar age. Climax shrub species were reestablishing on sagebrush disturbances much more readily than were climax trees species within coniferous disturbances.

This difference in rate of community development between the two vegetation types may be attributable to several factors. Drilling in a forested area creates an opening in the forest canopy, consequently eliminating the shaded environment. Various tree species found in the native coniferous communities sampled during this study are known to have different tolerances to sunlight. *Abies lasiocarpa* is considered a shade tolerant species as opposed to the shade-intolerant *Pinus contorta* (Ronco, 1976). Data of Appendix D indicate *P. contorta* was the primary tree species establishing on older disturbed openings, yet seedlings were generally absent from adjacent native communities. *Abies* was the dominant species in all native sites. *Pinus* may be considered a mid-seral species in the openings, with *Abies* a dominant, late seral/climax species within native communities. Another obvious reason for slower rates of return to predisturbance conditions in coniferous than in sagebrush areas is the fact that trees are slow growing species. Therefore, creation of an environment conducive to shade tolerant species is an equally slow process.

The unshaded environment of coniferous type disturbances is also detrimental to species indigenous to the native understory. Shrubs such as *Vaccinium scoparium* and the common forb components of forested zones, such as *Arnica cordifolia*, *Antennaria racemosa* and *Osmorhiza chilensis* are also shade tolerant species. These species were encountered in very low percentages or not at all within disturbances (Appendix D).

Soils

Changes in soil characteristics may be major factors affecting vegetation within disturbances. Several physical and chemical properties were found to be altered on nearly every disturbed soil relative to adjacent undisturbed soil. Certain of these differences persisted in soils of the oldest disturbed sites sampled.

Bulk Density

Average bulk densities were significantly greater (at varying α levels) in disturbed than in native soils at all depths sampled. This increased density is logical in view of the heavy rubber tired and track machinery that is used on sites before and after drilling operations. Such machinery is known to cause increased soil compaction (Forest Service, 1979). An additional factor possibly contributing to increased bulk density on non-reclaimed sites is the removal of upper soil horizons during site preparation. This procedure leaves B or C horizons at the surface after abandonment, which are often more dense than the surface horizons in adjacent undisturbed soils.

Heavily compacted soils, those with bulk densities greater than $1.5 g/cm^3$, can have a detrimental effect on plant establishment for a number of reasons. Compacted soils generally exhibit reduced pore space which consequently increases soil matric potential and thus reduces the availability of soil moisture to plant roots (Hill and Sumner, 1967). Water availability on compacted soils may also be diminished due to reductions in infiltration and increases in runoff. Compacted soils sometimes have been noted to have reduced organic matter and nitrogen content, which would have an inhibitory effect on plant growth (Youngberg, 1959). This inverse relationship between bulk density and organic matter was observed in the soils sampled in this study. Linear regression analysis indicated a significant (α of .01, Appendix E) negative correlation between the two parameters. Bulk densities of 1.6 to $1.8 g/cm^3$ (which were exhibited by many of the disturbed site soils sampled) have been shown to reduce root penetration (Foil and Ralston, 1967; Zimmerman and Kardos, 1961). Reduced seedling growth has often been found to be strongly associated with increases in bulk density, regardless of soil textural classes (Foil and Ralston, 1967).

Mean effective rooting depth was significantly shallower in disturbed than in native site soils for grouped sites within both vegetation communities. This general reduction in root extension could be attributed to both the increased compaction found in the disturbed soils and the increased volume of coarse fragments occurring in these soils.

Coarse Fragments

The higher percentage of coarse fragments within disturbed soils may be an unavoidable consequence of drill site preparation. In the process of contouring and leveling a site, fragments lying at deep depths are exposed and mixed with the surface soil materials. This is especially prevalent on sites being prepared in steep terrain, which require extensive cutting and leveling of slopes before a drilling apparatus can be erected (Law et al., 1981).

Rocky soils exhibit lower water holding capacities, but increased depth of water penetration (Hillel and Tadmore, 1962). Growth of deep rooting shrub and forb species thus eventually may be favored by the presence of coarse fragments.

The presence of surface rockiness has been reported (Redente, et al., 1981) to be a major factor contributing to reduced seedling success due to poor seed to soil contact. This relationship may have been responsible for the exceptionally poor vegetation cover noted on several sites which had high percentages of surface rock (Appendix D).

pH

Soil pH was usually higher in disturbed than in native soils. However, within the sagebrush vegetation type, disturbed-native soil pH's were not sufficiently different to warrant a change in acid or alkaline classification. Therefore, disturbed soils did not pose a drastically different environment to vegetation in terms of acidity or alkalinity.

Soil pH within the coniferous vegetation type demonstrated greater variation between native and disturbed soils. Most of the native soils ranged in pH from 5.2 to 6.6, which is a normal range expected on forested soils (Spurr and Barnes, 1973). These soils are classified as strongly to slightly acid. pH values for associated disturbed soils were generally within the neutral to slightly alkaline range of 7.0 to 7.6 This decrease in acidity in disturbed soils could inhibit the establishment of species indigenous to forested communities which are best adapted to acid soils, hence slowing successional development. Vaccinium scoparium is one example of an acid tolerant species (Weaver and Clements, 1929) which was encountered in several of the native communities and notably absent on associated disturbances.

In the coniferous vegetation type, the removal of vegetation and the surface layer of humus (composed primarily of acid inducing pine needles) has apparently had a notable effect on pH. Soil acidity has been decreased through mixing soil layers and thus diluting the surface humus content, even on topsoiled sites. These recently disturbed soils are no longer influenced by coniferous vegetation, nor has sufficient time elapsed for natural leaching processes to substantially affect the cations present in the soil.

Organic Matter

Percent organic matter in the upper 5 cm of disturbed soils was generally lower than that in native soils. This is the depth at which organic matter is actively being deposited from aboveground biomass and being decomposed and cycled into the soil. This continual process of organic matter cycling is disrupted by the removal of vegetation and subsequent scraping and stockpiling of topsoil, necessary steps for drill site preparation. The process of organic matter accumulation and decomposition must begin anew on recently abandoned sites, resulting in lower initial organic matter content on the disturbed soil surface.

Reduction in soil organic matter content on drill sites may adversely effect vegetation reestablishment due to the following factors. Organic matter is very important to soil structure, soil water holding capacity and is

the major source of essential plant nutrients. Nearly all nitrogen, up to 60 percent of the phosphorus and up to 80 percent of the sulfur found in soil is available only through organic matter (Donahue et al., 1977; Brady, 1974). Results of linear regression analysis (Appendix E) on soils of this study demonstrated a positive correlation between organic matter and available phosphorus (α of .01). Percent organic matter, in conjunction with clay content, has a positive relationship with cation exchange capacity. Organic matter content in soils has an inverse relationship with erodibility (Glover et al., 1978). The presence of organic matter improves soil structure, pore space and aeration through its ability to aggregate and bind soil particles.

Soil Texture and Associated Nutrient Content

Texture in general and clay content in particular were usually little changed by drilling disturbances. As a result (and despite differences in organic matter content), cation exchange capacity for disturbed soils was generally very similar to that for native soils, although specific exceptions to this did occur.

Concentrations of phosphorus and potassium, both essential nutrients for plant growth, were sometimes reduced slightly in disturbed soils. However, this relationship and degree of difference fluctuated site by site. Among all disturbed soils sampled, concentrations of both nutrients did not appear to be seriously deficient as a result of drilling disturbance.

Time

The degree and nature of disturbance revegetation was certainly influenced by time (i.e., site age since abandonment). None of the disturbed site plant communities closely resembled surrounding undisturbed communities in terms of absolute cover or species composition. However, within the sagebrush vegetation type there was a gradual trend of convergence between communities over time. The fact that plant community redevelopment is a slow process is evidenced by the large differences observed between the oldest disturbances sampled and their native counterparts.

Several soil properties related to fertility status were found to change with age since site abandonment. However, major changes in soil morphology or structure were not detectable over the relatively short time frame provided by this study. The processes of soil genesis needed to create horizons and structure in a profile are known to take centuries (Spurr and Barnes, 1973; Curry, 1975).

Soil properties which did change with time included percent organic matter, available phosphorus and exchangeable potassium. Within the sagebrush zone only, organic matter and phosphorus increased with time in disturbed soils relative to native soil levels. Within the coniferous vegetation type, potassium concentrations were greater on more recently abandoned sites than adjacent native soils. This initial difference was not observed on older sites, where potassium concentrations were either similar between disturbed and native soils or greater in the native soils.

Due to the complex and longevous nature of plant succession/soil genesis and the short time frame offered by this study, it is not possible to

accurately predict the time necessary for complete recovery of either a disturbed sagebrush/grass or coniferous ecoystem. Results of this study can only reliably indicate that 33 years was insufficient for successional and soil genesis processes to reconstruct the ecosystems disturbed. Data collected suggested decades for partial recovery to centuries for complete recovery of these disturbances.

Applied Reclamation Practices

Direct consequences of applied reclamation treatments on plant community development were not easily identifiable due to the fact that only the more recently abandoned sites (< 21 years) received any kind of reclamation treatment, and applied reclamation treatments differed among sites.

The first steps in reclamation, recontouring the site and reapplying topsoil (when it has been stockpiled), appeared to have a stabilizing affect on the soil and the vegetation occupying it. The presence of a contoured slope may promote vegetation establishment by improving water dispersal and infiltration into the soil, thus reducing the chances of gully and rill erosion. Vegetation on recontoured sites was consistently more uniform in cover than the random patches observed on untreated, older sites.

Seed mixtures applied to reclaimed sites were composed primarily of introduced grass species. Exclusive use of such vigorous, competitive species has been reported to inhibit the reestablishment of native species indigenous to an area (Laycock 1980; Schuman and Rauzi, 1980; Sindelar, 1978). However, while seeded disturbances were dominated by introduced grasses, non-seeded native species also were present. The seeded sites generally possessed as many (or more) species in common with native communities as did older, non-treated sites (Appendix F).

Shrub species reestablishment on reclaimed sites was very limited in terms of cover, but much more promising with respect to density. All but two of the reclaimed sites did have shrubs present. Therefore, an extensive cover of perennial grasses did not completely prevent shrub establishment.

Linear regression analysis of similarity indices among seeded sagebrush sites and adjacent native sites indicated a significant (α of .2) increase in similarity as age since abandonment increased. A similar analysis of all sagebrush sites (seeded and nonseeded) yielded a slower increase of similarity with time. This suggests that seeding of introduced grasses in conjunction with recontouring actually accelerated native species reestablishment within the sagebrush zone.

In contrast to sagebrush sites, results of linear regression analysis of seeded sites within the coniferous type yielded a negative (α of .2) correlation between similarity indices and age since abandonment. As previously discussed (Fig. 7), however, seeding with introduced grass species appeared to accelerate the establishment of native shrub and forb species onto coniferous zone disturbances. The contradiction between this relationship and the reduction in similarity over time is attributable to the identity of plants, whether seeded/introduced or nonseeded/native, recolonizing the disturbances. Such species were predominantly shade intolerant species not found in the adjacent woodland communities, which reduced similarity. These

differences may be due to the reclamation practice of seeding grasses only rather than introducing tree species in conjunction with grasses, shrubs, and forbs (Ronco, 1976), which perhaps could more rapidly produce a shaded environment conducive to reinvasion of indigenous understory forb and shrub species.

Results of this study suggest that recontouring and rapidly establishing vegetation through seeding may accelerate the recovery of a disturbed ecosystem if properly conducted, (e.g., as on sagebrush disturbances), but may retard or delay recovery if improperly designed (e.g., as on coniferous disturbances). Recommendations for improved reclamation practices based upon results of this study will be discussed shortly.

Adapted/Beneficial Species

Proper plant species selection is of obvious importance in applied reclamation/revegetation programs (DePuit, 1982). A knowledge of species existing on a site prior to disturbance is very important if ultimate reestablishment of predisturbance conditions is desired. However, predisturbance presence does not guarantee that species will be easily established immediately after disturbance. As we have demonstrated in this study, post-disturbance topographic, edaphic and biologic (i.e., successional) conditions are often radically different than antecedent conditions, and sometimes may preclude or delay establishment of certain pre-disturbance plant species.

Throughout sampling, plant species were identified which appeared adapted to colonizing disturbed areas. Certain of these species may prove beneficial as components of seed mixtures applied to accelerate plant community development towards a pre-disturbance condition. Tables 3 and 4 separately list major species occurring on disturbances within the sagebrush and coniferous vegetation types. Only those species with mean cover $\geq$1.0 percent and/or frequency $\geq$ 25 percent were included. Listed species associated with each vegetation type were then grouped according to their occurrence on specific soil types, elevations and annual precipitation zones to identify any possible adaptational relationships (Appendix G). From these data, species with potential value for inclusion in seed mixtures were identified primarily in terms of apparent adaptation to disturbed site conditions (Monson and Plummer, 1978; Brown, 1980). Plant species other than those identified in this data set may certainly also have potential for disturbed site revegetation.

Perennial Grasses

Within the sagebrush zone, several grass species (both native and introduced) exhibited wide ecological adaptability, suggesting their broad potential as initial colonizers/stabilizers of disturbed sites. Bromus inermis (an introduced grass) was the most ubiquitous of these species, occurring on all disturbances sampled regardless of soil type, elevation or amount of precipitation. However, Bromus inermis was found on only one of the adjacent native communities.

Poa pratensis, now considered a naturalized, introduced species (Cronquist et al., 1977), occurred on five disturbed sites as well as four native communities. This species also exhibited a large range of

TABLE 3. Sagebrush sites: cover and frequency of dominant and/or common species on disturbed zones[1], and associated native zone values.

Species	Mean Cover (%)[2] Disturbed Sites	Mean Cover (%)[2] Native Sites[4]	Frequency of Occurrence (%)[3] Disturbed Sites	Frequency of Occurrence (%)[3] Native Sites
PERENNIAL GRASSES				
*Agropyron intermedium	1.0	0	38	0
Agropyron trachycaulum	4.0	5.4	38	38
*Bromus inermis	8.4	.1	100	13
Bromus marginatus	.5	.1	38	25
*Dactylis glomerata	11.1	0	25	0
Deschampsia caespitosa	6.0	0	25	0
*Festuca arundinaceae	2.8	0	13	0
Festuca idahoensis	2.0	12.2	25	25
Hesperochloa kingii	.9	3.1	25	25
Hordeum brachyantherum	2.4	.1	25	13
Koeleria cristata	.6	1.4	25	25
*Phleum pratense	2.2	0	38	0
Poa canbyi	.7	.5	38	25
Poa palustris	.5	.7	38	38
*Poa pratensis	2.5	.3	62	50
GRASSLIKES				
Carex microptera	.9	.7	38	13
LEGUMINOUS FORBS				
Lupinus sericeus	2.5	3.8	25	13
PERENNIAL FORBS				
Achillea millefolium	.8	2.4	88	63
Aster chilensis	3.7	2.5	62	38
Eriogonum umbellatum	1.2	3.2	25	25
Geranium viscossimum	.6	.2	25	13
Potentilla gracilis	1.4	1.6	38	25
Taraxacum officinale	3.2	.3	100	100
SHRUBS				
Artemisia tridentata var. vasevana	4.0	19.0	88	88
Artemisia cana	2.8	4.6	25	25
Symphoricarpos spp.	.9	4.3	25	25

1/ i.e., species with mean cover ≥1.0% and/or frequency ≥ 25% on disturbed zones.
2/ Among sites where species occurred.
3/ Among 8 sites
4/ Refers only to native sites associated with a disturbed site containing the listed species
* Introduced species

TABLE 4. Coniferous sites: cover and frequency of dominant and/or common species on disturbed zones[1], and associated native zone values.

	Mean Cover (%)[2]		Frequencey of Occurrence (%)[3]	
	Disturbed Sites	Native Sites[4]	Disturbed Sites	Native Sites
PERENNIAL GRASSES				
*Agropyron cristatum	3.8	0	14	0
*Agropyron intermedium	1.7	0	29	0
Agropyron trachycaulum	1.9	.3	57	29
*Bromus inermis	6.6	0	100	0
*Dactylis glomerata	12.5	0	29	0
*Phleum pratense	1.7	0	29	0
Poa canbyi	1.2	0	14	0
Poa curta	.8	0	29	0
*Poa pratensis	1.0	1.0	43	14
Trisetum spicatum	.5	.3	57	14
GRASSLIKES				
Carex rossii	1.6	.7	43	14
LEGUMINOUS FORBS				
Lupinus argenteus	.6	1.7	29	29
*Trifolium pratense	5.8	0	57	0
PERENNIAL FORBS				
Achillea millefolium	1.4	1.0	86	43
Antennaria microphylla	1.3	0	43	0
Antennaria racemosa	.6	4.6	29	29
Fragaria virginiana	.5	3.5	43	29
Taraxacum officinale	2.7	1.4	86	43
SHRUBS AND TREE SEEDLINGS				
Abies lasiocarpa	.6	7.4	57	57
Artemisia tridentata var. vaseyana	.5	0	29	0
Pinus contorta	1.7	0	29	0

1/ i.e. species with mean cover ≥1.0% and/or frequency ≥29% on disturbed zones.
2/ Among sites where species occurred
3/ Among 7 sites
4/ Refers only to native sites associated with a disturbed site containing the listed species.
* Introduced species

adaptability, occurring on all soil types, elevations and precipitation zones encountered. Agropyron intermedium and Phleum pratense, both introduced species, were sampled on three disturbed sites with loam and sandy textured soils. The native species Agropyron trachycaulum and Poa palustris were sampled on three disturbed/native site pairs. Both species appeared best adapted to sandy soil conditions and elevations greater than 2400 m; however, neither appeared restricted to a particular precipitation zone.

Additional perennial grass species were encountered on sagebrush zone disturbances which may not offer high potential for rapid initial establishment, but which may be well suited to accelerating the successional process if applied to a disturbance. These mid-seral, indigenous species included Festuca idahoensis, Hesperachloa kingii, Koeleria cristata, Deschampsia caespitosa, and Hordeum brachyantherum. Festuca appeared best adapted to sandy soil textures, although it also occurred on a clay textured soil. Both Hesperachloa and Koeleria were sampled on loamy and sandy soils having large amounts of surface and subsurface rock. Neither Festuca or Koeleria appeared restricted to a particular elevation range or precipitation zone, whereas Hesperachloa occurred only on upper elevation sites exhibiting both high and low annual precipitation. Deschampsia caespitosa was found on two sagebrush sites with both high elevation and precipitation. Both of these sites had sandy soils. Though this species was not sampled in the adjacent native communities, it is a common species in upper elevation environments (Brown and Johnston, 1978). Hordeum brachyantherum was also found on two upper elevation disturbances with sandy soils. The above species could prove beneficial in reclamation seed mixtures by increasing diversity if their adaptations are considered and seed is available.

A number of perennial grass species exhibited adaptability to coniferous type disturbances, suggesting utility as initial colonizers. Most of these species would not normally be present in a forested habitat type and few were actually encountered on adjacent undisturbed sites. The most notable were certain seeded introduced grasses. Bromus inermis was the most widespread species, contributing substantial canopy cover to every disturbed site. Poa pratensis occurred on three disturbed sites. This species occurred on both clay and loam soils and did not appear to be restricted by the amount of precipitation received (< > 65 cm) or the elevation of the site. Dactylis glomerata was well established on the two most recently abandoned sites, each of which presented different ecological conditions. One site was located at 2950 m and had a loam soil texture, while the other was located at 2380 m with a clay soil texture. Both Phleum pratense and Agropyron intermedium were sampled on two disturbed sites. A. intermedium provided considerable cover on both clay and loam soils and in both upper and lower elevations and precipitation zones. Phleum occurred only on sites having loam soils, but was not restricted by elevation or precipitation.

Several native grass species appeared adapted to initial colonization of coniferous disturbances. Agropyron trachycaulum and Trisetum spicatum both occurred on four of the seven disturbed sites. Agropyron exhibited the greatest cover on sites with a loam soil texture, although it did occur on one site with a clay texture. This species also occurred on both high and low elevation sites. Trisetum was tolerant of all soil types, but was restricted to elevations greater than 2500 m and an annual precipitation greater than 65

cm. Although native, neither of these species were common in undisturbed communities due to their shade intolerance.

Introduced grasses discussed in this section may be beneficial on disturbed sites in terms of adaptation and soil protection. However, due to their competitive nature, caution must be used when seeding introduced species so as not to apply them so heavily that they outcompete desirable, less vigorous native species (DePuit, 1980; Sindelar, 1980).

Native grass species discussed could also offer utility as components of reclamation seed mixtures. However, use of native grasses on coniferous zone disturbances should be confined to shade intolerant species expected to survive in the disturbed opening. Shade tolerant species may fail to establish, and may do best if allowed to later recolonize naturally in the shaded environment of an older, more successionally advanced plant community. The practice of planting grasses on abandoned coniferous zone disturbances is implemented primarily to protect the soil resource. This established vegetation may then accelerate the successional process by creating an environment more conducive to the establishment of later seral species (shrubs and trees with the associated grass and forb understory components) (Brown, 1980).

Leguminous Forbs

Lupinus sericeus was the only leguminous forb sampled on more than one disturbed sagebrush site. It occurred on two sites with loam and sandy textured soil. It was confined to elevations less than 2400 m and was apparently unaffected by precipitation averaging greater or less than 65 cm.

A different species of lupine, argenteus, was sampled on two disturbed/native site pairs within the coniferous type. This species was found on both clay and sandy soils, but was restricted to upper elevation and precipitation zones. Although these and certain other Lupinus species may be suited to recolonization of disturbed sites, it is suggested that they not be included in seed mixtures because they sometimes can be poisonous to livestock (Forest Service, 1937).

Trifolium pratense, an introduced clover, had established on four coniferous type disturbances representing all three soil types and both upper and lower elevation and precipitation zones, suggesting adaptability to a variety of conditions. This species may also be beneficial in terms of symbiotic nitrogen fixation. T. pratense, therefore, could be a beneficial addition to reclamation seed mixtures for coniferous type disturbances.

Perennial Forbs

Perennial forbs are often important components of mid and late seral plant communities. If a return to such a community is the desired reclamation goal, these species can be used to augment the successional process. Taraxacum officinale and Achillea millefolium were found on nearly every disturbed site sampled regardless of surrounding vegetation, soil texture, elevation or precipitation. Both of these species are well recognized colonizers of disturbances (Monson and Plummer, 1978; Forest Service, 1937).

These species could be useful components of reclamation seed mixtures due to their ease of establishment and contribution to plant community diversity.

Two additional perennial forb species exhibited substantial cover on sagebrush disturbances. These species may have potential for stabilization as well as increased diversity if included in reclamation seed mixtures. Aster chilensis occurred on five disturbed sites and three adjacent native communities. This species established on all textures of soil as well as both upper and lower elevation and precipitation zones. This species has been recommended for rehabilitation of disturbed sites in the Intermountain region due to its sod-forming growth characteristics which offer protection to unstable soils (Plummer et al., 1968; Monson and Plummer, 1978). Potentilla gracilis was sampled on three disturbed sites and two adjacent native communities. This species was confined to sites with loam or sandy soil texture but appeared to be unrestricted by elevation or precipitation.

The forbs Eriogonum umbellatum and Geranium viscosissimum may be included in sagebrush disturbance seed mixtures to increase vegetation diversity. These species were sampled on several disturbances, but did not occur in concentrations sufficient to indicate high adaptation for initial colonization. However, limited initial presence of such slower-establishing species could accelerate their later spread on a disturbance.

Several perennial forb species exhibited potential for initial colonization on coniferous zone disturbances. Both Antennaria microphylla and Fragaria virginiana occurred on three disturbed sites, with Fragaria present on two adjacent native communities and Antennaria absent from all native communities. Antennaria appeared adapted to all three soil types and both upper and lower elevation and precipitation zones. Fragaria was found only on low elevation sites with either clay or loamy soils. Antennaria racemosa, a species characteristic of coniferous understory communities, was sampled on the two oldest disturbed sites. Apparently this species will reestablish naturally provided a shaded environment is available, as was the case on these older disturbances.

Shrubs and Trees

Shrubs and/or trees are integral, dominant components of mid and late seral plant communities in both the sagebrush and coniferous vegetation types. Several shrub/tree species were found reestablishing on disturbed sites, although generally at slower rates than grasses.

Within the sagebrush zone, Artemisia tridentata ssp. vaseyana was the most common shrub species, occurring as a subdominant species on seven of the eight disturbed sites surveyed. It was also present as a dominant species in every associated native community. This species was apparently not restricted to any particular soil textural type, elevation or precipitation zone. Artemisia cana was sampled on the two disturbed sites where it had occurred prior to drilling activities. This species appeared adapted to both clay and sandy soil textures and both upper and lower elevation and precipitation zones.

Several tree and shrub species were reestablishing on coniferous disturbances. Abies lasiocarpa provided only limited canopy cover on four of

the seven disturbed sites surveyed, although it was usually a dominant tree within adjacent native communities. Abies occurred on disturbances within all three soil textural classes and both upper and lower elevation and precipitation zones. Thus, while Abies may have quite broad adaptational amplitude, its ability for initial colonization of disturbances is reduced due to intolerance of the prevailing non-shaded conditions. Pinus contorta occurred on two disturbed sites with both loamy and sandy soils. Although cover of Pinus seedlings was low, it was nontheless greater than that of Abies. Pinus was absent from the adjacent native communities, probably a direct result of it's shade intolerance. Therefore, Pinus would appear a more appropriate pioneer species on disturbed openings than Abies, and in fact, may help prepare an improved, shaded environment for Abies and other shade tolerant species over time. Although several shrubs occurred on disturbed coniferous sites, their concentrations were low indicating limited utility as initial coloninizers. These included Artemisia tridentata spp. vaseyana and Ribes viscosissimum.

Although several of the shrub and tree species cited above may be adapted to disturbed site conditions, their initial establishment through conventional seeding methods and/or general inclusion in seed mixtures with grasses has frequently proved difficult. Alternative approaches for introduction will be discussed shortly.

Implications For Reclamation Goals

The "success" of reclamation depends in large measure upon the objectives of the process. Several concepts exist on broad goals for disturbed ecosystem recovery. The restoration concept implies that the exact conditions of a site before disturbance will be recreated (Box, 1978). Another alternative is termed rehabilitation, which involves returning a disturbed site to a form and productivity in conformity with a predetermined land use which may or may not be the same as before disturbance (Box, 1978). The third widely recognized concept is known as reclamation. This implies that a disturbed site will be returned to a condition which will be approximately equal to or better than the condition of the area prior to disturbance in terms of sustained support of functional physical processes, biological organizations and land uses (DePuit, 1983). Selection of one of these concepts must be made in cognizance of its short and long-term feasibility. This includes taking into consideration present/potential technology and ecological constraints, as well as its appropriateness to site/situation-specific conditions and needs.

Throughout this study, disturbed site communities were compared to an adjacent native community chosen to represent the disturbed site's condition prior to drilling disturbance. Use of this comparative approach relates primarily to the restoration concept noted above. Restoration is probably not a realistic short-term reclamation goal in light of the results of this study, although it may conceivably be achievable over longer periods of time. Reestablishment of a predisturbance native community where original vegetation had been removed and the soil altered did not occur on any of the sites sampled over the 33 year time frame studied. Although the sagebrush zone disturbances were progressing toward predisturbance conditions more rapidly than those in the coniferous type, both were developing at slow rates. Data analysis suggested that regeneration of predisturbance shrub and tree communi-

ties on retopsoiled and seeded sites could take decades on shrublands and as long as several centuries on coniferous sites. Similar estimates on the amount of time required to restore a disturbed ecosystem have been made by other researchers. Tisdale and Hironaka (1981) indicated that at least 40 years would be necessary for the reestablishment of sagebrush communities onto abandoned cropland in eastern Wyoming. Ronco (1976) reported that 200 to 300 years may be necessary for the reestablishment of climax spruce fir vegetation on high elevation disturbances.

In contrast to restoration, results of this study do suggest feasibility of the reclamation and/or rehabilitation options for drilling disturbances, particularly if cultural practices are applied. Many of the sagebrush disturbances did, in fact, support plant communities that, while not identical to undisturbed communities, were judged capable of soil stabilization and either immediate or potential support of similar land uses. This suggests the short-term feasibility of reclamation. Conversely, rehabilitation may comprise the most immediately feasible option for disturbances in the coniferous zone, since certain of the graded, seeded disturbances exhibited adequate revegetation and soil stabilization attributable to plant communities radically different than those on surrounding lands. On such sites, the rehabilitated condition may be permanently maintained if it satisfies predetermined land use needs (e.g., increased habitat/forage diversity for wildlife or livestock) or eventually converted to undisturbed conditions satisfying the reclamation/restoration options.

While results of this study are encouraging on reclamation/rehabilitation over the short-term, however, many problems remain to be addressed by improved applied reclamation technology. Although grading and seeding of drill sites often appeared to accelerate site recovery, the specific methods applied were usually rather rudimentary relative to technology developed and implemented on other types of disturbance in other regions. In short, comprehensive determination of the reclamation potential and recovery rates of drill sites in the study area cannot be made until improved methods are developed, applied and subsequently evaluated.

SUMMARY

Results of this study have revealed a number of plant community development relationships for abandoned oil and gas drilling disturbances. Changes in chemical and physical properties of disturbed soils, the nature or lack of post-drilling land treatment and insufficient time for successional development have all contributed to significant differences in vegetation cover and composition between disturbed and adjacent native sites.

The first broad objective of this study was to evaluate the present successional status of disturbed communities in reference to adjacent undisturbed communities and suggest the amount of time which may be required for recovery of these areas to a predisturbance condition. Total and individual plant class canopy cover were generally lower on disturbed sites, and large differences in individual plant species occurrence and cover were found between disturbed and native sites. Several general patterns of vegetation development were exhibited on more recently abandoned ($\leq$ 21 years since abandonment), seeded sites. These sites, in both vegetation types (sagebrush and coniferous), did not exhibit an initial dominance by annual species shortly after abandonment. Perennial grasses dominated sites during the early years following abandonment with very low abundance of perennial forbs or shrubs/trees. With time, however, both of the latter plant classes increased on disturbances. However, although total cover for plant classes became more similar over time, plant species composition within each class remained very different between disturbed and native communities over the short time span (ca. 33 years) represented by sites surveyed. Regression analysis-based predications of time required for complete recovery to pre-disturbance condition were developed. Although of questionable absolute reliability, they suggested a longer time frame for species (i.e., centuries) than for plant class (i.e, decades) compositional recovery, and far slower rates of recovery in the coniferous than in the sagebrush vegetation type.

The second broad objective of this study was to evaluate the relationship between the type of vegetation surrounding disturbances and the rate of recovery toward undisturbed vegetation conditions. Comparisons between sagebrush and coniferous vegetation types indicated that disturbed site vegetation in the sagebrush type was developing more rapidly towards a pre-disturbance condition. This was evidenced by both the convergence of disturbed-native site plant class cover values and the increasing similarity of plant community species composition between sites over time. In contrast, the coniferous type sites exhibited a much slower rate of plant class equalization and a trend of decreasing species composition similarity between disturbed and native sites with time.

The third broad study objective was to determine effects of seeding and other applied reclamation practices on site recovery. Within the sagebrush vegetation type, the combination of recontouring disturbed topography, reapplying topsoil and seeding various introduced species accelerated site recovery and succession. Native plant species did reestablish under these applied reclamation techniques, in most cases at a more rapid rate than that observed on older, non-treated sites. Recontouring and topsoiling reclamation practices apparently provide a much improved growing medium for both seeded and naturally colonizing species. Seeded species proved beneficial by both stabilizing the site and improving the soil through organic matter contribu-

ted. All of these factors provide an environment which encouraged the reestablishment of native, later seral stage species, thus accelerating the successional process.

Conventional reclamation practices applied to coniferous zone disturbances were beneficial in terms of site vegetational stabilization. Sites seeded with perennial grasses alone also exhibited more rapid establishment of both perennial forbs and shrub/tree seedlings than did older sites which revegetated naturally. However, seeded sites exhibited decreasing species compositional similarity to adjacent native communities over time. Therefore, seeding with introduced grasses alone appears to retard or delay recovery toward predisturbance conditions in the coniferous zone. This suggests the need for modified revegetation techniques if accelerated progression toward such conditions is a reclamation goal.

This study's fourth objective was to identify plant species which are well adapted to colonization of disturbed sites and which consequently may prove beneficial for reclamation purposes. On disturbances within the sagebrush type a number of perennial species exhibited a wide ecological amplitude and high potential for initial colonization/stabilization. These species included Bromus inermis, Poa pratensis, Poa canbyi, Bromus marginatus, Taraxacum officinale, Achillea millefolium, Aster chilensis and Potentilla gracilis. Additional species which exhibited superior colonizing characteristics but were restricted to certain soil types or elevation/precipitation zones within the sagebrush type included Agropyron intermedium, Phleum pratense, Agropyron trachycaulum, and Poa palustris. Other species were identified as potentially beneficial for sites with specific conditions within the sagebrush zone. Festuca idahoensis appeared adapted to sandy soils, Hesperachloa kingii and Koeleria cristata were present on loamy and sandy soils having large amounts of surface rock, while Deschampsia caespitosa and Hordeum brachyantherum were adapted to upper elevations and sandy soils. The forb species Eriogonum umbellatum and Geranium viscosissimum may also contribute to increased diversity in newly established vegetation. Major shrub species recurring on the sagebrush disturbances were Artemisia tridentata ssp. vaseyana and Artemisia cana. Although these shrubs may have low potential for initial establishment, they are apparently adapted and may perhaps be incorporated into communities using specialized planting techniques.

Within the coniferous zone, species with the broadest adaptational amplitude and highest potential for initial colonization included Bromus inermis, Poa pratensis, Trifolium pratense, Taraxacum officinale, Achillea millefolium and Antennaria microphylla. Species occurring on disturbed sites with narrower adaptational amplitude included Dactylis glomerata, Phleum pratense, Agropyron intermedium, Agropyron trachycaulum and Trisetum spicatum. These latter species may have potential benefits in terms of rapid colonization/stabilization or increased diversity if used in appropriate environments. Shrub/tree species were generally poorly represented on coniferous zone disturbances, although several species were sporadically encountered. Of these, Pinus contorta was considered to offer the best immediate potential for colonization.

The final objective of this study was to determine what soil properties are altered by drilling disturbance and the possible effect of such on

vegetation establishment. Soil horizonation and structure on disturbed sites were virtually destroyed by the excavation and mixing of surface and subsurface soil layers. Soil was much more compacted on disturbed than on native sites. Organic matter content was generally lower in the upper 5 cm of disturbed soils. The increased compaction and lowered organic matter content of disturbed site soils can reduce soil water infiltration and retention, soil tilth and nutrient availability. Soil nutrient concentrations were not found to be seriously reduced by disturbance when averaged among all sites. On an individual site basis, relative concentrations of available phosphorus, exchangeable potassium and exchangeable cations fluctuated between disturbed and native sites. Soil texture was not significantly changed by disturbance. Soil pH was increased by disturbance on all sites sampled. This was especially so on sites within the coniferous zone, where disturbed site soils were generally neutral as compared to acidic soils on native sites.

This study revealed several plant community development relationships that were somewhat contrary to results of other disturbed land studies. First, annual plant species were not major colonizers of disturbances soon after abandonment, as is generally expected in early seral development. Second, the presence and/or dominance of seeded introduced grasses did not always inhibit the reestablishment of indigenous species. Third, plant community diversity on disturbed sites did not consistently, progressively increase with time, and appeared - if considered alone - to be an inappropriate indicator of successional development.

RECOMMENDATIONS

Improved Reclamation Practices

This study demonstrated benefits of even rudimentary applied reclamation practices on oil/gas disturbance recovery. Results (in conjunction with prior work elsewhere) allow formulation of a number of general recommendations for improvement of reclamation practices that may further enhance disturbance recovery. Success in drill site reclamation depends upon prudent planning/goal determination, site preparation, plant materials selection, revegetation methods and subsequent management. Recommendations for each of the above areas are summarized below.

Planning and Goal Determination for Reclamation

This study demonstrated varying degrees of environmental uniqueness for every site surveyed. Therefore, the importance of site-specific design of reclamation programs for individual disturbances in the study area is both obvious and paramount. Similarly, the goals--short and long-term--of reclamation should reflect site/situation specific conditions, constraints and land-use needs.

Practical and ecological feasibility must also be considered in setting reclamation goals. This study has suggested the infeasibility of exact restoration of pre-disturbance conditions over the short-term, but that either reclamation to a similar condition (on sagebrush disturbances) or rehabilitation to a different although still useful condition (on coniferous disturbances) may be feasible. Irrespective of the broad goal scenario selected for any site (i.e., restoration, reclamation or rehabilitation), it must be recognized that immediate site stabilization against erosion will be a universal initial requisite for later success.

The dynamic, developmental nature of vegetation and soils on disturbances was firmly demonstrated by this study, and must be recognized in both reclamation planning and goal setting. Immediate achievement of long-term goals should not be expected (or required) but, rather, acceptable trends toward desired ultimate conditions should be achieved through reclamation practices properly based upon successional principles.

Site Preparation

Disturbed sites must be properly manipulated by reclamation practices to provide a physical and chemical base conducive to subsequent recovery. Results of this study have supported the importance of regrading drill sites to slopes that will reduce soil erosion and promote vegetation establishment. Slopes often should resemble the original contour. However, in cases where original slopes were overly steep or erodable the new grade must meet more acceptable standards of functioning with surrounding undisturbed topography. Due to the compaction usually observed on disturbances, it is recommended that recontoured sites be ripped to alleviate this subsoil condition.

When present in sufficient quantity and of good quality, topsoil should be removed and stockpiled prior to drilling and subsequently reapplied to the recontoured site after abandonment. This topsoiled surface should also be

ripped, chiseled and/or harrowed to relieve the compaction resulting from the machinery required for topsoil reapplication. Such topsoil usually provides an improved growth medium for plants in terms of physical/chemical characteristics, and may contain propagules of indigenous plants.

An organic mulch should be used on sites where slopes are excessively steep or soils are unusually unstable, rocky and/or low in organic matter, or where prevailing climatic conditions may pose a threat to seedling establishment. Organic mulch material should be applied after seeding to hold the soil in place, conserve water and add organic matter to the soil. The latter benefit may prove especially important in light of the reduction in soil organic matter content found on most disturbed sites, and the former in light of the required importance of immediate soil stabilization. Steep, erosive slopes may also require application of certain specialized surface manipulation techniques (e.g., pitting, furrowing, etc.)

Disturbed site soils generally were not deficient in phosphorus or potassium. However, levels of nitrogen were not determined during analysis; the possibility exists that this nutrient could be in short supply on some soils. The application of fertilizer could alleviate any existing nutrient deficiencies or enhance plant growth on severely disturbed sites with limited quantities of topsoil material. The potential for positive fertilizer response would also be expected to be greatest on sites receiving the most precipitation.

Plant Species Selection

Plant species selection must be based upon an integrated consideration of autecological/adaptational characteristics, ease of initial establishment, synecological/successional relationships, functional utility and practical availability. The origin of a plant species (i.e., native or introduced) may be irrelevant if it meets these criteria.

Adaptation to prevalent environmental conditions is an obvious requirement for any plant species selected. As summarized earlier, this study revealed a number of plant species, both native and introduced, which exhibited either broad or narrow adaptation to disturbed site conditions. If such (or other) species satisfy the other criteria noted above, their use in reclamation seed mixtures is certainly recommended. An important point demonstrated by this study is that species adapted to predisturbance edaphic/topographic/biologic conditions may not necessarily prove adapted to the radically different conditions created by disturbance.

The seed mixture to be used must be designed to guarantee that a stand of vegetation will be present the first growing season to stabilize and protect the soil resource and add organic matter to the soil. Ease of initial establishment, either inherent or induced by available cultural practices, becomes an important characteristic of selected plant species and may not always be directly correlated with adaptation when mature. Although perennial grasses are sometimes excessively competitive with woody species, these species are recommended for universal inclusion in seed mixtures due to their demonstrated general ease of establishment, role as early seral species and soil stabilization capabilities.

Synecological (i.e., interspecific) relationships are of critical importance in selecting mixtures of species for initial or later introduction, especially competitive and successional relationships. Seeding overly competitive and/or longevous species may reduce concurrent establishment of less vigorous yet desired species, or (as evidenced by seeded coniferous sites in this study) may delay or retard the successional changes desired.

Interspecific compatibility may be controlled by judicious choice of either the presence or proportion of species with different establishment/vigor characteristics within mixtures, or by temporal differences in initial introduction of species with different characteristics. To exemplify the former approach, species with exceptional vigor may not be seeded at all or seeded at lower rates than less vigorous species. The latter approach can be illustrated by either delayed seeding of exceptionally vigorous species (i.e., after less initially competitive species become well-established) or delayed introduction of species characteristic of later stages of succession. For example, initial seeding of later seral stage species may be ill advised except for species exhibiting wide seral amplitude (i.e., components of both early and latter successional stages). Later-seral stage species which are difficult to establish initially may later colonize the site naturally or possibly be interseeded or transplanted following initial site revegetation.

This study suggested that the greatest initial establishment and synecological compatibility problems were associated with the shrub and tree species which dominated adjacent, undisturbed lands. Due to the often reported difficulty of establishing shrub and tree species through seeding in conjunction with perennial grasses and forbs, it may be necessary to insure establishment using alternate planting techniques. Other potential methods include: 1) sowing shrub or tree seed in strips between grass seed strips (Richardson and Trussell, 1981), 2) scalping portions of established vegetation and sowing seed in these bare areas (Guinta et al., 1975; Plummer et al., 1968) or 3) planting bareroot or containerized stock of desired shrubs or trees (Stevens, 1981). In some cases, as with Artemisia tridentata ssp. vaseyana in the study, it may be acceptable to allow a shrub/tree species to reestablish naturally. However, in situations where accelerated reestablishment of shrub/tree species is mandatory (i.e., within a coniferous community being managed for timber harvest or areas proposed for wilderness designation) it may be necessary to use these or other alternate methods of woody species establishment.

Species selected for reclamation must also possess desirable utilitarian characteristics, in terms of either reclamation/successional processes or desired land uses. For example, certain "pioneer" species may be seeded that are not expected to persist but which may nontheless perform an important temporary role in succession (such as site stabilization, site modification, etc.). Species introduced for longer- term persistence should, of course, be amenable to the type of land use and management anticipated.

Lastly, species selected should have seed, transplants or other propagules readily available in sufficient quantities for general use. For example, commercial seed/transplant availability may be a problem for certain of the adapted native species defined by this study. If propagules for

such species prove unattainable through native collections, their inclusion in seed mixtures will be impossible.

Management and Evaluation

Although proper post-revegetation management may be critically important to long-term site recovery, results of this study do not allow many firm recommendations to be directly drawn on management principles. Basically, management practices may be applied to initially reclaimed sites to either temporarily protect them from deleterious outside influences, correct shortcomings of initial practices, and/or manipulate sites toward desired ultimate conditions over time. Although not a general or significant problem, livestock and/or wildlife use was noted on nearly all disturbances surveyed. Such use, if excessive, could in some situations require initial site protection until vegetation becomes sufficiently established to withstand grazing or trampling. Similarly, disturbances in areas with heavy recreational usage may require protective management. However, practical achievement of initial site protection may prove more difficult for extensive oil/gas disturbances than for other more localized disturbances (e.g., mining).

Recurring erosion problems and/or partial revegetation failures were noted on several sites that had been initially treated with reclamation practices. Such problems indicate the occasional need for corrective management practices. Such practices may include repeated mulching, regrading, supplemental interseeding or weed control, depending upon the specific problem encountered.

None of the disturbances surveyed had yet achieved a state that might be considered "fully" reclaimed. If, through inspection or more detailed monitoring, initially revegetated sites appear to be progressing unacceptably in terms of rate or direction of development, management practices to direct and accelerate succession may prove necessary. Such "manipulative" management practices may include controlled, varied grazing systems, supplemental interseeding/transplantation, varied maintenance fertilization strategies and mowing/haying, to name but a few. Again, the nature, rate and direction of disturbed site succession will be influenced not only by prevailing environmental conditions and initially applied reclamation practices, but also by management. Proper management is, therefore, just as important as preceding phases of the reclamation process.

Periodic monitoring of initially treated disturbances is recommended to provide a basis for management decisions and also to allow evaluation of applied reclamation methods. Again, this study suggests that trend analysis may be the most meaningful, feasible approach to reclamation evaluation in light of the long time frame of succession. If reclamation success is to be evaluated in terms of vegetation resemblance to or trend toward native condition, this study indicates that disturbed-native site similarity indices may be the best approach. Such indices could be used in conjunction with other information (e.g., absolute cover and/or biomass, diversity, etc.) to assess the overall status of plant community development.

Future Research And Development

This study was hampered by extreme site-to-site variability and consequent lack of experimental control, lack of site-specific information, and the static approach used to study disturbed site recovery. Consequently, most of the recommendations in the preceding section are both broad and based upon inference rather than demonstrated fact, and must be recognized as such.

Due to the above shortcomings and the general lack of information on reclamation of oil/gas relative to other types of disturbances, the need for further research becomes strongly evident. Controlled, well designed and fully documented studies should be initiated on "new" disturbances in the region representative of the wide range of environmental conditions encountered. Such studies should empirically document both short and long-term effects of varied reclamation treatments. Such applied research is especially needed with respect to the applicability and effects of varied site preparation methods (grading, topsoiling, surface manipulation, mulching, fertilization, and tillage) plant materials and mixture design, revegetation methods (seeding/transplantation methods, timing, etc.) and management. Such research is necessary because reclamation technology developed elsewhere may not be completely applicable to oil/gas disturbances in the study area. In short, oil/gas disturbances in the study area exert impacts that are in some ways unique under widely varying environmental conditions. This necessitates development of a reclamation technology, through research and demonstration, that also is in many ways unique.

Further insight could also be gained by sampling soils and vegetation on the sites studied during this project in the future. The development of each individual site could then be directly ascertained, and the effects of seeding, time and other factors could be more concretely determined.

LITERATURE CITED

Alyea, J.D. 1966. Climatological Summary - Jackson, Wyoming. Agric. Exp. Sta., unnum. Univ. Wyo., Laramie.

Alyea, J.D. 1969. Climatological Summary - Afton Wyoming. Agric. Expt. Sta. unnum. Univ. of Wyo., Laramie.

Alyea, J.D. 1970. Climatological Summary - Big Piney, Wyoming. Agric. Exp. Sta. unnum. Univ. Wyo. Laramie.

Anschutz, P.F. 1980. The Overthrust Belt: will it double U.S. gas reserves? World Oil. 190(1):111-116.

Antos, J.A. and R.C. Shearer. 1981. Successional development in Abies grandis (Dougl.) forbs forests in Swan Valley, western Montana. Northwest Sci. 55(1):26-29.

Austin, M.P. 1977. Use of ordination and other multivariant descriptive methods of study succession. Vegetatio 35:165-175.

Avery, T.E. 1967. Forest Measurements. McGraw-Hill, New York.

Baker, F.S. 1944. Mountain climates of western United States. Ecol. Monogr. 14:223-254.

Beetle, A.A. 1961. Range survey in Teton County, Wyoming. Part I: Ecology of Range Resources. Wyo. Agr. Exp. Sta. Bull. 376.

Black, C.A. (ed.). 1965. Methods of Soils Analysis. Amer. Soc. Agron., Series No. 9, Madison, Wis.

Blackstone, D.L., Jr. 1971. Traveler's guide to the geology of Wyoming. Wyo. Geol. Surv., Bull. 55.

Box, T.W. 1978. The significance and responsibility of rehabilitating drastically disturbed land. p. 1-10. In: Reclamation of Drastically Disturbed Lands, F.W. Schaller and P. Sutton (eds.) Amer. Soc. Agron., Crop Sci. Soc. Amer., Soil Sci. Soc. Amer., Madison, Wis.

Brady, N.C. 1974. The Nature and Properties of Soils. MacMillan Publishing Co., New York.

Bramble-Brodahl, M.K. 1978. Classification of Artemisia Vegetation in the Gros Ventre Area, Wyoming. M.S. Thesis. Univ. Idaho, Moscow, Idaho.

Brown, R.W., R.S. Johnston, B.Z. Richardson, and E.E. Farmer. 1976. Rehabilitation of alpine disturbances: Beartooth Plateau, Mt. p. 58-73. In: Proc. High-Altitude Revegetation Workshop No. 2, Colorado State Univ., Fort Collins.

Brown, R.W. and R.S. Johnston. 1978. Rehabilitation of a high elevation mine disturbance. p. 116-130. In: Proc. High Altitude Revegetation Workshop No. 3, Colorado State Univ., Fort Collins.

Brown, R.W. and R.S. Johnston. 1980. An assessment of revegetation techniques for alpine disturbances. p. 126-146. In: Proc. High Altitude Revegetation Workshop No. 4, Colorado State Univ., Fort Collins.

Brown, R.W. 1980. Revegetation with native and introduced plant Species. p. 9-16. In: Twenty-sixth Grass Breeders Work Planning Conference. June 18-20, Utah State Univ., Logan, Utah.

Bureau of Land Management, USDI and Forest Service, USDA. 1983. Riley Ridge Natural Gas Project, Draft Environmental Impact Statement, U.S. Govt. Printing Office.

Chambers, J.C. 1983. Measuring species diversity on revegetated surface mines: an evaluation of techniques. U.S.D.A. Forest Service, Res. Paper, INT-322, Ogden, Utah.

Chambers, J.C. and R.W. Brown. 1983. Methods for Vegetation Sampling and Analysis on Revegetated Mined Lands. U.S.D.A., Forest Services Gen. Tech. Rep. INT-151, Ogden, Utah.

Connell, S.H. 1978. Diversity in tropical rainforests and coral reefs. Science 199:1302-1310.

Cook, C.W. and C.D. Bonham. 1977. Techniques for Vegetation Measurements and Analysis for a Pre- and Post-Mining Inventory. Range Science Dept., Science Series No. 28. Colorado State Univ., Fort Collins.

Cronquist, A., A.H. Holmgren, N.H. Holmgren, J.L. Reveal, and P.K. Holmgren. 1977. Intermountain Flora: Vascular Plants of the Intermountain West, U.S.A. Vol. 6. Columbia Univ. Press, New York.

Curry, R.R. 1975. Biogeochemical limitations on western reclamation. p. 18-47. In: Practices in Problems of Land Reclamation in Western North America, M.K. Wali (ed.). Univ. of N.D. Press, Grand Forks.

Daubenmire, R.F. 1959. A canopy-coverage method of vegetational analysis. Northwest Sci. 33:43-64.

DePuit, E.J. 1982. Cool season perennial grass establishment on northern Great Plains mined lands: status of current technology. In: Symp. on Surface Coal Mining and Reclamation in the Northern Great Plains. Billings, MT.

DePuit, E.J. 1983. Crested wheatgrass for reclamation of drastically disturbed lands - panacea, anathema or neither. Presented at Crested Wheatgrass Symp., Utah State Univ., Logan.

Donahue, R.L., R.W. Miller and J.C. Shickluna. 1977. Soils: An Introduction To Soils and Plant Growth. Prentice-Hall, Inc. Englewood Cliffs, NJ.

Foil, R.R. and C.W. Ralston. 1967. The establishment and growth of loblolly pine seedlings on compacted soils. Soil Sci. Soc. of Amer. Proc. 31:565-568.

Forest Service, USDA. 1937. Range Plant Handbook. U.S. Dept. of Commer. Nat'l. Bur. Stand. Inst. Appl. Technol.

Forest Service, USDA. 1979. User Guide to Soils. Gen. Tech. Rep. Int-68. For. Serv. Int. For. and Range Exp. Sta. Ogden, UT.

Forest Service, USDA. 1980. Bridger-Teton National Forest Information brochure. U.S. Govt. Printing Office.

Glover, F., M. Augustine and M. Clair. 1978. Grading and shaping for erosion control and rapid vegetative establishment in humid regions. pp. 271-283. In: Reclamation of Drastically Disturbed Lands, F.W. Schaller and P. Sutton (eds.). Amer. Soc. Agron., Crop. Sci. Soc. Amer. and Soil Sci. Soc. Amer., Madison, Wis.

Greweling, T. and M. Peech. 1965. Chemical Soil Tests. Cornell Univ. Agr. Exp. Sta., Bull. 960. Ithaca, NY.

Giunta, B.C., D.R.Christensen and S.B. Monson. 1975. Interseeding shrubs in cheatgrass with a browse seeder-scalper. J. Range Manage. 28:398-402.

Hill, J.N.S. and M.E. Sumner. 1967. Effect of bulk density on moisture characteristics of soils. Soil Sci. 103:234-238.

Hillel, D. 1980. Fundamentals of Soil Physics. Academic Press, New York.

Hillel, D. and N. Tadmore. 1962. Water regime and vegetation in the central Negev Highlands in Israel. Ecology 43:33-41.

Hitchcock, C.L. and A. Cronquist. 1973. Flora of the Pacific Northwest. Univ. of Washington Press, Seattle, WA.

Horn, H.S. 1974. The ecology of secondary succession: In: Annual Rev. of Ecol. and Syst. 5:25-37.

Jaynes, A.J. and K.T. Harper. 1978. Patterns of natural revegetation in arid Southeastern Utah. J. Range Manage. 31:407-411.

Judd, B.I. 1940. Natural succession of vegetation on abandoned farm lands in Teton County, Mt. Agron. J. 32:330-336.

Law. D.L., L.L. Linscott and R.L. Hopkins. 1981. Rehab. Oil and Gas Technical Bulletin, No. 1. Bureau of Land Management. U.S. Government Printing Office.

Laycock, W.A. 1980. What is successful reclamation--a look at the concepts of adaptability, productivity, cover and diversity of seeded Species. pp. 1-17. In: Proc. NW Col. Land Recl. Sem. II, Steamboat Springs, CO.

Mackey, C.V. and E.J. DePuit. 1984. Natural revegetation of surface deposited spent oil shale in Colorado. Reclam. Reveg. Res. (in Press).

Miller, R.W., S. Honarvar and B. Hunsaker. 1980. Effects of drilling fluids on soils and plants: I. Individual Fluid Components. J. Environ. Quality. 9:547-552.

Monson, S.B. and A.P. Plummer. 1978. Plants and treatment for revegetation of disturbed sites in the intermountain area. pp. 155-173. In: The Reclamation of Disturbed Arid Lands, R.A. Wright (ed.). Univ. New Mexico Press, Albuquerque.

Moore, R.T., S.L. Ellis and D.R. Duba. 1977. Advantages of natural successional processes on western reclaimed areas. pp. 274-281. In: Fifth Symp. on Surface Mining and Reclamation, NCA/BCR. Louisville, KY.

Moseley, H.R. 1980. Drilling fluids and cuttings disposal. In: Symp. Research on Environmental Fate and Effects of Drilling Fluids and Cuttings. Jan. 21-24, Lake Buena Vista, FL.

Mueller-Dombois, D. and H. Ellenburg. 1974. Aims and Methods of Vegetation Ecology. John Wiley and Sons, New York.

Negus, N.L. and J.S. Findley. 1959. Mammals of Jackson Hole, WY. J. Mammalogy 40(3):371-381.

Nelson, D.W., S. Liu, and L.E. Sommers. 1980. Plant uptake of toxic metals present in drilling fluids. In: Symp. Research on Environmental Fate and Effects of Drilling Fluids and Cuttings. Jan. 21-24, Lake Buena Vista. FL.

Odum, E.D. 1969. The strategy of ecosystem development. Science 164:262-270.

Phillips, E.A. 1959. Methods of Vegetation Study. Holt and Co., New York.

Pielou, E.C. 1975. Ecological Diversity. John Wiley and Sons, Inc. New York.

Plummer, A.P. P.R. Christensen, and S.B. Monson. 1968. Restoring Big Game Range in Utah. Utah Div. Fish and Game Publ. 68-3. Ephraim.

Redente, E.F., T.B. Doerr, C.E. Mount, C.E. Grygiel, T.E. Sievers, and M. Biodini. 1981. Effects of plant species, soil material, and cultural practices upon plant sstablishment and succession. In: Revegetation Research on Oil Shale Lands in the Piceance Basin, E.F. Redente and C.W. Cook (eds.). Range Science Dept., Colorado State Univ., Ft. Collins.

Ronco, F. 1976. Regeneration of forest lands at high elevations in the central Rocky Mountains. p. 13-28. In: Proc. High Altitude Revegetation Workshop No. 2, Colorado State Univ., Fort Collins.

Schuman, G.E. and F. Rauzi. 1980. Production, composition and longevity of crested wheatgrass/native grass mixtures. Abstract, 33rd Ann. Mtg. Soc. Range Manage., San Diego, CA.

Shannon, C.E. and W. Weaver. 1973. The Mathematical Theory of Communication. Univ. of Illinois Press, Urbana, IL.

Sindelar, B.W. 1978. Successional development of vegetation on surface mined land in Montana. pp. 550-560. In: Ecology and Coal Resource Development, M.K. Wali (ed.). Pergamon Press, New York.

Sindelar, W.B. 1980. Achieving revegetation standards on surface mined lands. In: Adequate Reclamation of Mined Lands? pp.. 22:1-22"15. Sypm., Soil Conserv. Soc. of Amer. and WRCC-21, March 26-27, Billings, MT.

Skilbred, C.L. 1979. Plant succession on five naturally revegetated strip-mined deposits at Colstrip, Montana. Unpub. M.S. Thesis, Mt. State Univ., Bozeman.

Soil Conservation Service. 1975. Soil Taxonomy. Agric. Handbook No. 436. U.S. Govt. Printing Office.

Spurr, S.H and B.V. Barnes. 1973. Forest Ecology 2nd edition, Ronald Press, New York.

Steele, R., S.V. Cooper, D.M. Ondov, R.D. Pfister. 1983. Forest Habitat Types of Eastern Idaho-Western Wyoming. U.S.D.A. For. Serv. Res. Pap. Int.-144. Intermt. For. and Range Exp. Stn., Ogden, Utah.

Stevens, R. 1981. Techniques for planting shrubs on wildland disturbances. pp. 29-36. In: Proc. Shrub Establishment on Disturbed Arid and Semi-Arid Lands Symp. Dec. 2-3. Wyoming Game and Fish Dept., Laramie.

Tisdale, E.W. and M. Hironaka. 1981. The sagebrush-grass region: a review of the ecological literature. Forest, Wildlife and Range Exp. Stn., Bull. 33. University of Idaho, Moscow.

VerPloeg, A.J. 1979. The Overthrust Belt: An Overview of An Important New Oil and Gas Province: Geological Survey of Wyoming Public Information Circular No. 11.

VerPloeg, A.J. 1982. Wyoming's Oil and Gas Industry: Geological Survey of Wyoming Public Information Circular No. 17.

Wali, M.K. 1980. Succession on Mined Lands. p. 23:1-23:46. In: Adequate Reclamation of Mined Lands? - Symp. Soil Cons. Soc. of Amer. and WRCC-21, March 26-27, Billings, MT.

Weaver, J.E. and F.E. Clements. 1929. Plant Ecology. McGraw-Hill, New York.

Whitaker, R.H. 1953. A consideration of climax theory: the climax as a population and pattern. Ecol. Mon. 23:41-78.

Youngberg, C.T. 1959. The influence of soil conditions following tractor logging on the growth of planted Douglas-fir seedlings. Soil Sci. Soc. Amer. Proc. 23:76-78.

Youngblood, A.P. and W.F. Mueggler. 1981. Aspen Community Types on the Bridger-Teton National Forest in Western Wyoming. USDA For. Serv. Res. Pap. Int-272, Intermt. For. and Range Exp. Sta., Ogden, Utah.

Younkin, W.A. and D.L. Johnson. 1980. The impacts of waste drilling fluids on soils and vegetation in Alberta. In: Symp.: Research on Environmental Fate and Effects of Drilling Fluids and Cuttings. Jan. 21-24, Lake Buena Vista, FL.

Zimmerman, R.P. and L.T. Kardos. 1961. Effect of bulk density or root growth. Soil Sci. 91:280-288.

APPENDIX A

CLIMATIC DATA FOR BRIDGER-TETON NATIONAL FOREST REGION

TABLE 5. Total annual precipitation (cm) and frost free days at weather stations in the Bridger-Teton region (NOAA, 1949-1982).

	Afton		Big Piney		Bondurant		Jackson		Moose		Moran		Pinedale	
	Precip.	Frost Free Days	Precip.	Frost Free Days	Precip.	Frost Free Days	Precip.	Frost Free Days	Precip.	Frost Free Days	Precip.	Frost Free Days	Precip.	Frost Free Days
1949	-1/	-	-	-	-	-	-	-	-	-	-	-	-	-
1950	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1951	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1952	-	-	31	26	48	1	28	3	56	3	34	1	18	5
1953	-	-	15	23	49	1	28	2	71	6	46	2	18	45
1954	-	-	18	23	55	2	36	3	76	23	48	2	21	77
1955	-	-	19	1	70	1	42	3	94	6	70	8	22	1
1956	-	-	12	11	51	1	27	11	64	5	53	5	27	5
1957	53	9	29	11	60	4	32	10	80	11	65	86	35	11
1958	42	1	17	2	44	1	30	1	-	2	53	104	-	50
1959	39	6	18	-	48	3	31	3	42	19	49	20	25	20
1960	41	9	18	12	52	1	36	47	53	66	54	66	26	35
1961	40	1	14	27	56	1	35	17	55	105	67	94	18	17
1962	41	5	18	18	42	3	33	12	43	71	49	79	-	33
1963	54	6	31	34	62	1	52	1	68	1	65	1	31	6
1964	52	58	26	51	72	5	51	44	63	53	77	65	28	54
1965	48	15	27	15	52	1	43	14	56	14	55	61	32	14
1966	34	18	18	34	50	3	35	7	42	51	52	52	20	48
1967	54	54	24	63	55	3	51	45	59	48	66	81	33	46
1968	46	1	27	1	55	1	40	6	48	1	62	1	44	1
1969	41	4	17	1	39	1	37	1	48	4	53	1	24	1
1970	46	14	24	21	64	11	43	14	51	13	74	29	29	14
1971	54	67	24	30	86	1	53	1	68	1	74	1	28	1
1972	50	25	25	7	83	1	53	8	52	9	71	8	34	7
1973	54	7	22	12	72	9	45	11	56	12	60	12	32	11
1974	37	4	13	20	42	1	29	30	45	-	59	32	14	30
1975	45	35	-	-	60	1	44	38	63	35	79	61	28	34
1976	38	29	-	17	44	-	39	8	42	16	54	60	25	15
1977	52	-	-	25	57	1	39	31	58	41	64	44	-	41
1978	42	-	-	32	37	1	36	6	66	50	58	63	-	50
1979	27	70	-	-	24	3	22	9	44	20	36	70	17	41
1980	60	37	27	20	48	7	49	19	63	41	65	37	31	20
1981	53	9	-	-	42	8	42	13	55	8	63	20	29	14
1982*	58	15	-	-	37	1	33	80	40	72	49	71	26	81
AVERAGE	46 cm	21	21 cm	20	53 cm	3	38.5 cm	14	58 cm	24	54 cm	39	26 cm	25

*Eight month period from January-August.

1/ Data not available from the reporting station.

APPENDIX B

EQUATIONS FOR SHANNON-WIENER DIVERSITY INDEX (PIELOU, 1975) AND SPATZ INDEX OF SIMILARITY (MUELLER-DOMBOIS AND ELLENBURG, 1974)

Shannon-Weiner Diversity Index (H'):

$$H' = -\sum_{i=1}^{n} P_i \log P_i$$

$$P_i = \frac{N_i}{N}$$

N_i = Cover value of species i

N = Sum of all species cover values

Spatz Index of Similarity (ISsp):

$$ISsp = R \times \frac{Mc}{Ma + Mb + Mc} \times 100$$

R = The sum of the smaller quantitative value of each species common to the two communities divided by the greater quantitative value. The total is divided by the number of species present in both communities.

Ma = The sum of the relative cover values of species found only in the first community.

Mb = The sum of the relative cover value of species found only in the second community.

Mc = The sum of the relative cover values of species common to both communities.

APPENDIX C

SUMMARY OF EXTENSIVE SURVEY OF 91 ABANDONED DRILL SITES

The following pages summarize qualitative information gathered during the 1981 extensive survey of abandoned drill sites in the Bridger-Teton National Forest. Reference photographs for each site have been submitted to/are available from the Logan, Utah office of the Intermountain Forest and Range Experiment Station.

General locations of sites surveyed were given in Figure 4. The following summaries provide more detailed information on site location, elevation, physiography, applied cultural (reclamation) practices, date of abandonment, nature of surrounding vegetation and site recovery following abandonment. Additional information on site size, configuration and plant species composition is available from the authors.

Site #: 1 Elevation: 2486m
District: Kemmerer Date Abandoned: 10/59
Location: 26 N 116 W Sec 23 SESW Topographic Map: Fontenelle Basin
Physiography: Site is nearly level, having a 3% slope. It is bordered on the west by a 30% east facing slope.
Cultural Practice: No seeding treatment recorded.
Native vegetation types: Populus tremuloides - Abies lasiocarpa/Rudbeckia occidentalis.
Site Recovery: Site has been camped upon resulting in scattered bare areas, remainder of site has been reinvaded by Bromus inermis and Agropyron cristatum as well as native grasses and perennial forbs.
Road Closure: Site is accessible by vehicle via the Little Bear Creek road.

Site #: 2 Elevation: 2470m
District: Kemmerer Date Abandoned: 8/57
Location: 26 N 116 W Sec 26 SWNE Topographic Map: Fontenelle Basin
Physiography: Site is flat to a southeastern aspect with a 3-5% slope.
Cultural Practice: Unknown, does not appear to have been seeded.
Native vegetation types: Populus tremuloides-Pseudostsuga menziesii/Artemisia tridentata.
Site Recovery: Site is predominated by grass and forb species from the adjacent sagebrush community with Artemisia tridentata and Populus tremuloides invading.
Road Closure: Site accessible by vehicle via the Little Bear Creek road.

Site #: 3 Elevation: 2789m
District: Kemmerer Date Abandoned: 9/63
Location: 28 N 117 W Sec 29 SESE Topographic Map: Graham Peak
Physiography: Site is flat.
Cultural Practice: Seeded, but seed mixture unknown.
Native vegetation types: Populus tremuloides-Abies lasiocarpa with a grass/forb understory.
Site Recovery: Site is rocky with sparse introduced grass and native forb cover along with invading Artemisia tridentata, Pinus contorta and Picea englemanni.
Road Closure: Site is accessible by vehicle via a jeep trail east of the Hobble Creek Road.

Site #: 4 Elevation: 2826m
District: Big Piney Date Abandoned: 1/58
Location: 28 N 115 W Sec 13 SESE Topographic Map: Pine Grove Ridge
Physiography: Site has slopes ranging from 2-15 % and a northeasterly aspect.
Cultural Practice: Unknown.
Native vegetation types: Mixture of forbs, Taraxacum officinale, Antennaria spp, Penstemon spp. in conjunction with several Carex species.
Site Recovery: Site is well vegetated with several native Agropyron species and numerous forbs and is also supporting Artemisia tridentata and A. frigida not found on the adjacent native range.
Road Closure: Site is accessible by vehicle via a side road due south of the Pine Grove Ridge Road.

Site #: 5 Elevation: 2970m
District: Big Piney Date Abandoned: 1/68
Location: 28 N 115 W Sec 14 SWSE Topographic Map: Pine Grove Ridge
Physiography: 2-10 % slope, eastern aspect.
Cultural Practice: Seeded, now predominantly Agropyron cristatum
Native vegetation types:
Site Recovery: Site had pumping equipment on it at the time of reconnaisance.
Road Closure: Site is immediately adjacent to the Pine Grove Ridge Road.

Site #: 6 Elevation: 3013m
District: Big Piney Date Abandoned: 9/73
Location: 28 N 115 W Sec 15 NESE Topographic Map: Pine Grove Ridge
Physiography: 3-8 % slope, northeastern aspect.
Cultural Practice: Area was seeded, but the mixture was not recorded.
Native vegetation types: Abies lasiocarpa with a sparse understory of Artemisia tridentata and several grass and forb species.
Site Recovery: Site is rocky with a sparse vegetation cover predominated by Phleum pratense, Bromus inermis and Trifolium spp. (Intensively sampled summer of 1982).
Road Closure: Site is accessible by vehicle and is due north of the Pine Grove Ridge Road.

Site #: 7 Elevation: 3025m
District: Big Piney Date Abandoned: 10/72
Location: 28 N 115 W Sec 15 NENW Topographic Map: Pine Grove Ridge
Physiography: 3-15 % slope, northern aspect.
Cultural Practice: Seeded with Bromus inermis at 10 lbs/A and Onobrychis viciaefolia at 5 lbs/A.
Native vegetation types: Pinus albicaulis-Abies lasiocarpa/Artemisia tridentata.
Site Recovery: Site is sparsely revegetated with introduced grass species, however there are several Artemisia tridentata and Pinus albicaulis plants present on the site.
Road Closure: Road has been closed midway to the site.

Site #: 8 Elevation: 3070m
District: Big Piney Date Abandoned: 7/54
Location: 28 N 115 W Sec 22 SENW Topographic Map: Pine Grove Ridge
Physiography: 2-10 % slope, southern aspect.
Cultural Practice: Site was reported to have been seeded, but the mixture is unknown.
Native vegetation types: Pinus albicaulis-Abies lasiocarpa/Artemisia tridentata.
Site Recovery: Site is quite bare and has been heavily disturbed by vehicle traffic.
Road Closure: Road is accessible by vehicle.

Site #: 9 Elevation: 2967m
District: Big Piney Date Abandoned: 1/79
Location: 28 N 115 W Sec. 26 SENE Topographic Map: Pine Grove Ridge
Physiography: 3-8 % slope, generally flat to northeasterly aspect.
Cultural Practice: Seeded using Bromus inermis at 5 lbs/A, Dactylis glomerata at 5 lb/A, Phleum pratense at 5 lbs/A, Agropyron intermedium at 5 lbs/A and Trifolium hybridum at 1 lb/A.
Native vegetation types: Abies lasiocarpa-Pinus contorta/mixed forb understory.
Site Recovery: Sparse vegetation cover consisting of seeded grass species (intensively sampled summer of 1982).
Road Closure: Site is accessible by vehicle via side road north east of Deadline Ridge Road.

Site #: 10 Elevation: 3036m
District: Big Piney Date Abandoned: 1974
Location: 28 N 115 W Sec 4 SENE Topographic Map: Pine Grove Ridge
Physiography: 1 - 12% slope, northern aspect.
Cultural Practice: Seeded with 5 lbs/A of Bromus inermis, 5 lbs/A. of Phleum pratense, 5 lbs/A. of Agropyron intermedium and 1 lb/A. of Trifolium hybridum.
Native vegetation types: Artemisia tridentata/Agropyron spicatum-Geum triflorum with scattered Abies lasiocarpa and Pinus flexilis.
Site Recovery: Sparse vegetation cover, predominantly seeded species.
Road Closure: Site is accessible by vehicle via Deadline Ridge Road.

Site #: 11 Elevation: 2405m
District: Big Piney Date Abandoned: 9/61
Location: 29 N 115 W Sec 11 SWSE Topographic Map: Springman Creek
Physiography: 4 - 15% slope, southeastern aspect.
Cultural Practice: Unknown
Native vegetation types: Riparian vegetation including Salix spp. and numerous forbs, with South Piney Creek running near the southern edge.
Site Recovery: Site is supporting an extensive grass cover as well as Artemisia frigida, A. tridentata, Chrysothamnus nauseosus and Xanthocephalum sarothrae
Road Closure: Accessible by vehicle via South Piney Creek Road.

Site #: 12/13 Elevation: 2393
District: Big Piney Date Abandoned: 10/28-3/29
Location: 29 N 115 W Sec 11 SWSE Topographic Map: Springman Creek
Physiography: 2-5% slope, varied aspect
Cultural Practice: Unknown.
Native vegetation types: Riparian area along South Piney Creek, predominantly Salix spp. and Artemisia tridentata.
Site Recovery: Records show two separate wells, but there is only one pipe in the vicinity of the locations given. Both wells were probably drilled in approximately the same area. Site is completely revegetated by native vegetation.
Road Closure: Accessible by vehicle via South Piney Creek Road.

Site #: 14 Elevation: 2405m
District: Big Piney Date Abandoned: 3/48
Location: 29 N 115 W Sec 15 NESW Topographic Map: Mount Thompson
Physiography: Flat
Cultural Practice: Unknown.
Native vegetation types: Artemisia tridentata/grass.
Site Recovery: Site has been heavily impacted by vehicle traffic resulting in compacted areas devoid of vegetation, remainder of site has been revegetated with Artemisia tridentata, native grasses and forbs.
Road Closure: Site is accessible via South Piney Creek Road.

Site #: 15 Elevation: 2440m
District: Big Piney Date Abandoned: 8/75
Location: 29 N 115 W Sec.15 NESW Topographic Map: Mount Thompson
Physiography: Site has been recontoured resulting in a 10% slope on top, 23% slope towards the toe and 75% slope along the edge all with an eastern exposure.
Cultural Practice: Seeded in 1977 with 5 lb/A of Bromus inermis and 5 lbs/A of Phleum pratense.
Native vegetation types: Pinus contorta/Artemisia tridentata with a predominantly forb understory.
Site Recovery: Site is composed of sparse vegetation cover predominated by seeded grasses with some reinvading perennial forbs.
Road Closure: Site is accessible via South Piney Creek Road.

Site #: 16 Elevation: 2566m
District: Big Piney Date Abandoned: 1978
Location: 29 N 115 W Sec.35 NESW Topographic Map: Mount Thompson
Physiography: 10 % slope, north aspect.
Cultural Practice: Site was seeded in 1978 with 5 lbs/A of Lolium multiflorum, 5 lbs/A of Bromus inermis, 5 lbs/A of Phleum pratense, 5 lbs/A of Agropyron intermedium, 5 lbs/A of Alopecurus pratensis and 5 lbs/A of Trifolium repens.
Native vegetation types: Abies lasiocarpa-Pinus contorta.
Site Recovery: Site was very bare in 1981, with only scattered, unidentifiable grasses present. Site was fenced.
Road Closure: Unknown.

Site #: 17 Elevation: 2764m
District: Big Piney Date Abandoned: 10/65
Location: 29 N 115 W Sec.36 SWNE Topographic Map: Pine Grove Ridge
Physiography: 25 % slope, west aspect.
Cultural Practice: Seeded, but record of the mixture was unavailable.
Native vegetation types: Abies lasiocarpa-Pinus contorta/mixed forb understory.
Site Recovery: Well revegetated with introduced and native grasses and native forbs. Several Pinus contorta seedlings on site.
Road Closure: Site is accessible by foot only, below the Deadline Ridge Road.

Site #: 18 Elevation: 2529m
District: Big Piney Date Abandoned: 12/73
Location: 30 N 115 W Sec.2 NWNE Topographic Map: Springman Peak
Physiography: Unknown.
Cultural Practice: Seeded with 10 lbs/A of Bromus inermis and 10 lbs/A of Agropyron desertorum.
Native vegetation types: Artemisia tridentata/grass.
Site Recovery: The native range adjacent to this site had been sprayed with 2-4D in June of 1981 to control sagebrush. In the process, the site also received the herbicide, making it unsuitable for sampling. This site was not visited due to time constraints.

Site #: 19 Elevation: 2514m
District: Big Piney Date Abandoned: 7/29
Location: 30 N 115 W Sec.35 NENE Topographic Map: Springman Peak
Physiography:
Cultural Practice:
Native vegetation types:
Site Recovery: This site has never been located by district personnel and did not appear on aerial photos. Road access to the site's approximate location is very limited and due to time restrictions, this site was not located.
Road Closure: Unknown.

Site #: 20 Elevation: 2573m
District: Big Piney Date Abandoned: 7/29
Location: 32 N 115 W Sec.12 NESW Topographic Map: Maki Creek
Physiography: 2-5 % slope, varied aspect
Cultural Practice: Unknown.
Native vegetation types: Artemisia tridenta/grass.
Site Recovery: Site sits on a bench above South Cottonwood Creek and below road. Wellpipe is located only four feet from the road and has been knocked over. Area has completely recovered, making it difficulty to discern a disturbance boundary.
Road Closure: Site is accessible via South Cottonwood Creek Road.

Site #: 21 Elevation: 2558m
District: Big Piney Date Abandoned: 12/78
Location: 32 N 115 W Sec.15 NESW Topographic Map: Triple Peak
Physiography: 2-10 % slope, eastern aspect.
Cultural Practice: Seeded 12/78 with 10 lbs/A of Bromus inermis, 5 lbs/A of Phleum pratense and 5 lbs/A of Trifolium spp.
Native vegetation types: Pinus contorta-Abies lasiocarpa/Artemisia tridenta mosaic.
Site Recovery: Approximately 90% of sparse vegetation cover is composed of Monolepsis nuttalliana. Site has been fenced.
Road Closure: Site is accessible by vehicle via South Cottonwood Creek Road.

Site #: 22 Elevation: 2535m
District: Big Piney Date Abandoned: 11/77
Location: 33 N 114 W Sec.9 NWNE Topographic Map: Maki Creek
Physiography: 4 % slope, varied aspect.
Cultural Practice: Seeded in 1977 with 10 lbs/AC of Bromus inermis, 5 lbs/A of Phleum pratense and 5 lbs/A of Trifolium spp.
Native vegetation types: Populus tremuloides-Abies lasiocarpa with a thick forb understory on three sides and a shortgrass meadow on the fourth.
Sampling Suitability and remarks: Site is well revegetated with seeded grass species and reestablishing Artemisia tridentata.
Road Closure: Site is accessible by vehicle, only by crossing private land.

Site #: 23 Elevation: 2484m
District: Big Piney Date Abandoned: 11/61
Location: 33 N 114 W Sec.16 SWNW Topographic Map: Maki Creek
Physiography: 20-25 % slope, northeastern aspect.
Cultural Practice: Seeded, but record of seed mixture was unavailable.
Native vegetation types: Pinus contorta-Abies lasiocarpa/Sheperdia canadensis.
Site Recovery: Site is well revegetated with Bromus inermis, Phleum pratense and native forbs, with numerous shrub species and Pinus contorta invading. (intensively sampled summer of 1982)
Road Closure: Road directly into the site has been closed to vehicle traffic with the use of water-bar ditches. Road is recovering with a good cover of introduced grasses and native forbs, with conifers reestablishing.

Site #: 24 Elevation: 2486m
District: Big Piney Date Abandoned: Had not been
Location: 33 N 114 W Sec.19 SESW Topographic Map: Triple Peak
Physiography:
Cultural Practice:
Native vegetation types:
Site Recovery: Site was occupied by pumping equipment at the time of reconnaisance.
Road Closure: Accessible by vehicle.

Site #: 25 Elevation: 2485m
District: Big Piney Date Abandoned: Originally abandoned 6/60, but was redrilled in 1978.
Location: 33 N 115 W Sec.13 NENW Topographic Map: Triple Peak
Physiography: 0-5% slope, flat to northern aspect.
Cultural Practice: Seeded in 1980 with 10 lb/A of Bromus inermis, 5 lbs/A of Phleum pratense, 5 lbs/A of Agropyron intermedium, 5 lbs/A of Dactylis glomerata and 5 lbs/A of Trifolium spp.
Native vegetation types: Pinus contorta/Artemisia tridentata mosaic.
Site Recovery: Very little vegetation cover at the time of reconnaisance. Site had been fenced.
Road Closure: Site is accessible by vehicle via North Cottonwood Creek Road.

Site #: 26 Elevation: 2438m
District: Big Piney Date Abandoned: 10/80
Location: 33 N 114 W Sec.30 NESW Topographic Map: Maki Creek
Physiography: 2 % slope, varied aspect.
Cultural Practice: Seeded with 5 lbs/A of Bromus inermis, 5 lbs/A of Dactylis glomerata, 5 lbs/A of Phleum pratense, 5 lbs/A of Agropyron intermedium and 5 lbs/A of Trifolium hybridum.
Native vegetation types: Pinus contorta-Abies lasiocarpa/Artemisia tridentata mosaic.
Site Recovery: Site was essentially bare at the time of reconnaissance, with only scattered unidentifiable grasses present.
Road Closure: Site is accessible by vehicle via North Cottonwood Creek Road.

Site #: 27 Elevation: 2512m
District: Big Piney Date Abandoned: 10/72
Location: 34 N 114 W Sec.32 NESE Topographic Map: Prospect Peak
Physiography:
Cultural Practice:
Native vegetation types:
Site Recovery: The only access to this site is through private land, and we were not able to gain admittance at a mutually agreeable time. This site was not located.
Road Closure: Unknown.

Site #: 28 Elevation: 2718m
District: Big Piney Date Abandoned: 1978
Location: 35 N 114 W Sec.33 NESW Topographic Map: Prospect Peak
Physiography: 5-15 % slope, northern aspect.
Cultural Practice: Site was originally seeded with 5 lbs/A of Trifolium spp., 5 lbs/A of Bromus inermis and 5 lbs/AC of Phleum pratense. June of 1981, it was planted with 400-450 conifer trees per acre.
Native vegetation types: Abies lasiocarpa.
Site Recovery: There were scattered patches of introduced grasses reestablishing around the planted tree seedlings.
Road Closure: Road is closed to vehicle traffic midway to site with water-bar ditches.

Site #: 29 Elevation: 2930m
District: Big Piney Date Abandoned: 9/71
Location: 35 N 115 W Sec.25 SENW Topographic Map: Lookout Mountain
Physiography: 0-5 % slope, varied aspect.
Cultural Practice: Seeded, record of mixture was unavailable.
Native vegetation types: Carex/mountain forb.
Site Recovery: Site is well revegetated with several Carex spp, Deschampsia caespitosa, introduced grasses and native forbs (intensively sampled summer of 1982).
Road Closure: Accessible by foot only, due to road being washed out.

Site #: 30 Elevation: 2975m
District: Big Piney Date Abandoned: 8/79
Location: 35 N 115 W Sec.24 SESW Topographic Map: Lookout Mountain
Physiography: 3-8 % slope, varied aspect.
Cultural Practice: Seeded in 1979 using 5 lbs/A of Phleum pratense, 5 lbs/A of Agropyron intermedium, 5 lbs/A Bromus inermis and 5 lbs/A of Trifolium spp.
Native vegetation types: Artemisia tridentata/mountain forb, with scattered Abies lasiocarpa.
Site Recovery: Site is predominantly Dactylis glomerata, Agropyron intermedium, Bromus inermis and Trifolium spp (intensively sampled summer of 1982).
Road Closure: Accessible by foot only, due to road being washed out.

Site #: 31 Elevation: 3009m
District: Big Piney Date Abandoned: 10/71
Location: 35 N 115 W Sec.26 SENE Topographic Map: Lookout Mountain
Physiography: 3-12 % slope, southern aspect.
Cultural Practice: Seeded on 10/71, record of mixture was unavailable.
Native vegetation types: Artemisia tridentata/mountain forb, with scattered Abies lasiocarpa.
Site Recovery: Site is well revegetated with Bromus inermis, Agropyron intermedium, Trifolium spp and native forbs.
Road Closure: Accessible by foot only due to road being washed out.

Site #: 32 Elevation: 2247m
District: Greys River Date Abandoned: 6/49
Location: 30 N 118 W Sec.16 SWNE. Topographic Map: Smoot
Physiography: 3-15 % slope, flat to southeastern exposure.
Cultural Practice: Unknown.
Native vegetation types: Pinus contorta-Pseudostuga menziesii/Populus tremuloides-mountain forb mosaic.
Site Recovery: Site is well revegetated with native and introduced grasses and native forbs. Numerous shrub species, Salix spp, Populus tremuloides and Pinus contorta have reestablished on the site.
Road Closure: Accessible by vehicle, via private land.

Site #: 33 Elevation: 2492m
District: Greys River Date Abandoned: 10/49
Location: 30 N 119 W Sec.9 SWNE Topographic Map: Smoot
Physiography: 3 % slope, flat to southeastern exposure
Cultural Practice: None.
Native vegetation types: Artemisia tridentata/mountain forb.
Site Recovery: Site is located on an open shale ridge and is very sparsely revegetated wth native grasses, forbs and shrubs (intensively sampled summer of 1982).
Road Closure: Original road to site has been closed to vehicle use.

Site #: 34 Elevation: 2509m
District: Greys River Date Abandoned: 3/49
Location: 30 N 119 W Sec.15 NENW Topographic Map: Smoot
Physiography: Flat, varied aspect.
Cultural Practice: None.
Native vegetation types: Artemisia tridentata/mountain forb.
Site Recovery: There is a corral and salt lick adjacent to the site, consequently it has been grazed heavily and vegetation on the site is sparse.
Road Closure: Road to site is no longer accessible.

Site #: 35 Elevation: 2149m
District: Greys River Date Abandoned: 1977
Location: 33 N 116 W Sec.10 NWSE Topographic Map: Park Creek
Physiography:
Cultural Practice:
Native vegetation types:
Site Recovery: Site is being excavated for gravel and is not suitable for sampling. It was not located, due to this.
Road Closure: Unknown.

Site #: 36 Elevation: 2377m
District: Greys River Date Abandoned: 1978
Location: 35 N 117 W Sec. 14 SESW Topographic Map: Deer Creek
Physiography: 3-12% slope, east to southeastern aspect.
Cultural Practice: Seeded, but record of mixture is unavailable.
Native vegetation types: Abies lasiocarpa-Pseudostuga menziesii/mountain forb.
Site Recovery: Site is well revegetated with Dactylis glomerata as the predominant grass species, with several native shrub and forb species present (intensively sampled summer of 1982).
Road Closure: Site is accessible by vehicle via the Greys River Road.

Site #: 37/38 Elevation: 1950m
District: Greys River Date Abandoned: 1930, Reopened in 1970 and abandoned in 1971.
Location: 37 N 117 W Sec 25 SESE Topographic Map: Pine Creek Area
Physiography: 15 % slope, southern exposure, two well casings on site, treating this as one site.
Cultural Practice: Unknown.
Native vegetation types: Artemisia tridentata/Populus tremuloides mosaic.
Site Recovery: Area is well vegetated with an extensive grass cover and reestablishing Artemisia tridentata.
Road Closure: Site is accessible by vehicle via the Little Greys River Road.

Site #: 39 Elevation: 2420m
District: Pinedale Date Abandoned: 8/64
Location: 36 N 109 W Sec 20 SENW Topographic Map: New Fork Lakes
Physiography: 3-12 % slope, southern aspect.
Cultural Practice: Appears to have been seeded, but the mixture is unknown
Native vegetation types: Pinus contorta-Populus tremuloides/Artemisia tridentata mosaic.
Site Recovery: Site is extensively revegetated with introduced and native grasses and native forb cover, predominant species is Taraxacum officinale.
Road Closure: Directly adjacent to an accessible road.

Site #: 40 Elevation: 2438m
District: Pinedale Date Abandoned: 11/67
Location: 36 N 109 W Sec 20 NESW Topographic Map: New Fork Lakes
Physiography: Flat.
Cultural Practice: Unknown.
Native vegetation types: Populus tremuloides/Artemisia tridentata mosaic
Site Recovery: Site has been impacted by vehicle traffic resulting in scattered patches of vegetation.
Road Closure: Directly adjacent to an accessible road.

Site #: 41 Elevation: 2398m
District: Pinedale Date Abandoned: 7/64
Location: 36 N 109 W Sec 20 SWNW Topographic Map: New Fork Lakes
Physiography: 3-12 % slope, southwestern aspect.
Cultural Practice: Unknown.
Native vegetation types: Artemisia cana/mixed grass, scattered Populus tremuloides and Pinus contorta.
Site Recovery: Site is well revegetated with several Poa species, native forbs and Artemisia cana.
Road Closure: Accessible by foot from site 39.

Site #: 42 Elevation: 2404m
District: Pinedale Date Abandoned: 8/69
Location: 36 N 109 W Sec 20 SWNW Topographic Map: New Fork Lakes
Physiography: 2-5 % slope, southwestern aspect.
Cultural Practice: Unknown.
Native vegetation types: Populus tremuloide-Pinus contorta/Artemisia tridentata
Site Recovery: Site has been disturbed by vehicle traffic, vegetative cover consists of patches of grass and sedges.
Road Closure: Road is open.

Site #: 43 Elevation: 2398m
District: Pinedale Date Abandoned: 7/71
Location: 36 N 109 W Sec 20 SWSW Topographic Map: New Fork Lakes
Physiography:
Cultural Practice:
Native vegetation types:
Site Recovery: Unable to locate site.
Road Closure: Unknown.

Site #: 44 Elevation: 2532m
District: Pinedale Date Abandoned: 10/69
Location: 39 N 111 W Sec.22 NENW Topographic Map: Tosi Peak
Physiography: 3 % slope, varied aspect.
Cultural Practice: Unknown.
Native vegetation types: Artemisia tridenta-Salix sp./mixed forb.
Site Recovery: Site is very well revegetated with native species to the point that it is difficult to discern a site boundary.
Road Closure: Road to the site is accessible by foot only past Tosi Creek.

Site #: 45 Elevation: 2743m
District: Pinedale Date Abandoned: 6/58
Location: 39 N 111 W Sec.22 SWNE Topographic Map: Tosi Peak
Physiography: 3-5 % slope, varied aspect.
Cultural Practice: Unknown.
Native vegetation types: Artemisia tridentata/moist meadow forbs
Site Recovery: Site is very well revegetated with native grass and forb species along with Artemisia tridentata.
Road Closure: Road to the site is accessible be foot only past Tosi Creek.

Site #: 46 Elevation: 2654m
District: Pinedale Date Abandoned: 10/65
Location: 40 N 110 W Sec 26 SENE Topographic Map: Mosquito Lake
Physiography: 6-8 % slope, southern aspect.
Cultural Practice: Unknown.
Native vegetation types: Artemisia tridentata/mixed forb
Site Recovery: Site is well revegetated with introdcued grass species as well as native grasses, forbs and Artemisia tridentata (intensively sampled summer of 1982).
Road Closure: Site was located on foot by following an allotment fence which runs north to south and is east of Wayon Creek.

Site #: 47/48 Elevation: 2713m
District: Pinedale Date Abandoned: 11/60
Location: 40 N 110 W Sec 28 SESW Topographic Map: Mosquito Lake
Physiography: 1-6 % slope, composed of several small hills, holes located 40 m. apart, treating this as one site.
Cultural Practice: Unknown.
Native vegetation types: Artemisia tridentata/mixed forb, with a Pinus contorta and Picea engelmanni stand to the north and east.
Site Recovery: Area is well revegetated with native grasses and forbs, making it difficult to discern a site disturbance boundary.
Road Closure: Accessible via a jeep trail.

Site #: 49 Elevation: 2835m
District: Pinedale Date Abandoned: 11/60
Location: 40 N 110 W Sec 29 SWNW Topographic Map: Mosquito Lake
Physiography: 3 % slope, varied aspect.
Cultural Practice: Unknown, appears to have been seeded with several introduced grass species.
Native vegetation types: Pinus contorta with a thick forb understory on one side of the site and riparian vegetation on the others.
Site Recovery: Site is well revegetated with native species to the point that a disturbance boundry is difficult to discern. A large gully is running through the site.
Road Closure: Fallen logs across the road prevent vehicle traffic.

Site #: 50/51/52 Elevation: 2835m
District: Pinedale Date Abandoned: 11/60
Location: 40 N 110 W Sec 30 SESE Topographic Map: Mosquito Lake
Physiography: Flat.
Cultural Practice: Unknown, appears to have been seeded with Bromus inermis and Trifolium spp.
Native vegetation types: The area surrounding this site has been clearcut, prior to logging native vegetation was Pinus contorta/Vaccinium scoparium.
Site Recovery: Site is poorly revegetated with scattered annual forbs and introduced grasses.
Road Closure: Site is accessible by vehicle.

Site #: 53 Elevation: 2900m
District: Pinedale Date Abandoned: 9/71
Location: 40 N 110 W Sec 31 NENE Topographic Map: Mosquito Lake
Physiography: Site itself is flat, graded out of a 30% eastfacing slope.
Cultural Practice: Unknown, appears to have been seeded with Bromus inermis.
Native vegetation types: Area directly adjacent to this site has been clearcut. Prior to logging native vegetation was Pinus contorta/Picea englemanni.
Site Recovery: Site is sparsely revegetated with annual and perennial forbs and several introduced grass species.
Road Closure: Accessible by foot from area occupied by sites 50/51/52.

Site #: 54 Elevation: 2844m
District: Gros Ventre Date Abandoned: 10/72
Location: 40 N 111 W Sec 2 NWSE Topographic Map: Ouzel Falls
Physiography:
Cultural Practice:
Native vegetation types:
Site Recovery: This site was to be reclaimed during the time of reconnaissance and was not located.
Road Closure: Unknown.

Site #: 55 Elevation: 2829m
District: Gros Ventre Date Abandoned: 12/54
Location: 42 N 112 W Sec 11 SESE Topographic Map: Upper Slide Lake
Physiography: Series of benches, 1-3% grade on top and 10-22 % on the slopes, flat to northern aspect.
Cultural Practice: None.
Native vegetation types: Pinus albicaulis-Abies lasiocarpa/Vaccinium scoparium.
Site Recovery: Site is well revegetated with native grass, forb and shrub species with reestablishing Pinus contorta and Abies lasiocarpa. (intensively sampled summer of 1982)
Road Closure: Road to the site is open.

Site #: 56 Elevation: 2838m
District: Gros Ventre Date Abandoned: 7/60
Location: 42 N 112 W Sec 14 SWNE Topographic Map: Upper Slide Lake
Physiography: Site is a series of benches, slopes range from 3-10% with a northerly aspect.
Cultural Practice: None.
Native vegetation types: Pinus albicaulis-Abies lasiocarpa/Vaccinium scoparium
Site Recovery: Site is revegetated in patches by Agropyron pseudorepens, perennial forbs and Carex spp., with scattered individuals of Pinus contorta (intensively sampled summer of 1982).
Road Closure: Site is adjacent to an open road.

Site #: 57 Elevation: 2366m
District: Gros Ventre Date Abandoned: 12/76
Location: 42 N 113 W Sec 6 NESW Topographic Map: Mt. Leidy
Physiography: Site is located in a steep canyon, site itself has a 3% slope, canyon walls are 60-70%
Cultural Practice: seeded, but no record of mixture was available.
Native vegetation types: East facing slope is Artemisia tridentata/grass, westfacing slope is Populus tremuloides-Picea englemanni
Site Recovery: Site is supporting a thick cover consisting of Trifolium spp. Medicago sativa, Dactylis glomerata and Bromus inermis.
Road Closure: Road is closed to vehicles and is supporting a thick cover of introduced grasses.

Site #: 58 Elevation: 2198m
District: Gros Ventre Date Abandoned: 10/79
Location: 42 N 113 W Sec 24 NENW Topographic Map: Upper Slide Lake
Physiography: flat.
Cultural Practice: Seeded 10/79 with 1/2 lb/A each of Meliotus officinalis, Poa pratensis and Dactylis glomerata, 2 lb/A. of Agropyron intermedium and 1 lb/A. of Bromus inermis.
Native vegetation types: Artemisia tridentata/grass-forb.
Site Recovery: Seeded species are becoming well established. Native forbs and shrubs are reestablishing within seeded vegetation (intensively sampled summer of 1982).
Road Closure: Road to site has been closed to vehicles.

Site #: 59 Elevation: 2285m
District: Gros Ventre Date Abandoned: 8/49
Location: 42 N 114 W Sec 1 NESE Topographic Map: Mt. Leidy
Physiography: 5-10% slope, located in the same steep canyon as site 57.
Cultural Practice: Unknown at the time of abandonment, but site 57 is about .5 km up the draw from this site and road to it had been reclaimed in 1976, which affected this site.
Native vegetation types: East facing slope is Artemisia tridentata/grass, west facing slope is Picea englemanni -Abies lasiocarpa.
Site Recovery: Site is well covered with Bromus inermis, Poa spp., invading Circium spp. and several native forbs and shrubs.
Road Closure: Road is closed to vehicles and is supporting a thick cover of introduced grasses.

Site #: 60 Elevation: 2377m
District: Gros Ventre Date Abandoned: 8/52
Location: 43 N 114 W Sec 5 SESW Topographic Map: Shadow Mtn.
Physiography:
Cultural Practice:
Native vegetation types:
Site Recovery: Site was not located.
Road Closure: Unknown.

Site #: 61 Elevation: 2377m
District: Gros Ventre Date Abandoned: 8/52
Location: 43 N 114 W Sec. 5 SESW Topographic Map: Shadow Mtn.
Physiography:
Cultural Practice:
Native vegetation types:
Site Recovery: Site was not located
Road Closure: Unknown.

Site #: 62 Elevation: 2517m
District: Gros Ventre Date Abandoned: 11/55
Location: 43 N 114 W Sec. 9 NWNE Topographic Map: Shadow Mtn.
Physiography: 1-10% slope with a northeastern aspect, series of three benches.
Cultural Practice: Unknown.
Native vegetation types: Abies lasiocarpa-Populus tremuloides/wet meadow.
Site Recovery: Site is well revegetated with native grasses, forbs and shrubs and reestablishing Pinus contorta.
Road Closure: Road is open to the site.

Site #: 63 Elevation: 2852m
District: Gros Ventre Date Abandoned: 12/56
Location: 44 N 111 W Sec. 25 NENW Topographic Map: Togwotee Pass
Physiography: 1 % slope on top by pipe, 10 % slope with a northeastern aspect on remainder of site.
Cultural Practice: Seeded, but no record of mixture used was available.
Native vegetation types: Site is surrounded by three different community types. Wet meadow, Artemisia tridentata/grass and Picea englemanni mixed forb.
Site Recovery: Area around the well pipe has been disturbed by vehicle traffic, a portion of the site is being used to store salt blocks. Below this disturbance the site is well revegetated with introduced grasses and native forbs.
Road Closure: Road is open.

Site #: 64 Elevation: 2537m
District: Gros Ventre Date Abandoned: 10/74
Location: 44 N 112 W Sec. 31 SWSE Topographic Map: Green Mountain
Physiography: 2% slope, varied aspect.
Cultural Practice: Unknown.
Native vegetation types: Wet Meadow: Salix spp./mixed forb
Site Recovery: Site is well revegetated with a cover of native grasses and forbs to the point that a disturbance boundary is difficult to discern.
Road Closure: Site is adjacent to the Leidy Lake road.

Site #: 65 Elevation: 2544m
District: Gros Ventre Date Abandoned: 11/62
Location: 44 N 112 W Sec. 31 SESW Topographic Map: Green Mountain
Physiography: Flat.
Cultural Practice: Unknown.
Native vegetation types: Adjacent south facing slope is Abies lasiocarpa/Vaccinium scoparium, remainder of the site is surrounded by an open meadow with a mixed forb/grass vegetation.
Site Recovery: Site is revegetated with numerous native forbs and Agropyron intermedium.
Road Closure: Site is adjacent to the Leidy Lake road.

Site #: 66 Elevation: 2545m
District: Gros Ventre Date Abandoned: 11/62
Location: 44 N 112 W Sec. 31 SWSW Topographic Map: Green Mountain
Physiography:
Cultural Practice:
Native vegetation types:
Site Recovery: Site was not located.
Road Closure: Unknown:

Site #: 67 Elevation: 2529m
District: Gros Ventre Date Abandoned: 11/62
Location: 44 N 112 W Sec. 31 NENE Topographic Map: Green Mountain
Physiography: Flat.
Cultural Practice: Unknown.
Native vegetation types: Grass-forb meadow/Abies lasiocarpa-Picea englemanni
Site Recovery: Area around this site has been clearcut and there is a road running through the site. Site is partially revegetated with native forbs and grasses.
Road Closure: Road is open.

Site #: 68 Elevation: 2545m
District: Gros Ventre Date Abandoned: 11/50
Location: 44 N 112 W Sec. 31 SESW Topographic Map: Green Mountain
Physiography:
Cultural Practice:
Native vegetation types:
Site Recovery: Site was not located.
Road Closure: Unknown.

Site #: 69 Elevation: 2530m
District: Gros Ventre Date Abandoned: 11/58
Location: 44 N 113 W Sec. 13 NWNW Topographic Map: Rosies Ridge
Physiography: Flat.
Cultural Practice: Unknown.
Native vegetation types: Artemisia tridentata/mixed grass.
Site Recovery: Site and surrounding area was burned to control sagebrush approximately five years prior to the initial reconnaissance. Since then the site has become well revegetated with numerous native grasses and forbs with Artemisia tridentata reestablishing.
Road Closure: A locked gate prevents driving to the site, however, it is within very short walking distance.

Site #: 70 Elevation: 2611m
District: Gros Ventre Date Abandoned: 10/49
Location: 44 N 113 W Sec. 25 SESW Topographic Map: Green Mountain
Physiography: 3-10 % slope, eastern aspect.
Cultural Practice: Unknown.
Native vegetation types: Abies lasiocarpa/Vaccinium scoparium, with a moist area on the southeastern portion of the site.
Site Recovery: Upper portion of site is well revegetated with Bromus inermis, Taraxacum officinale and other native forbs. Pinus contorta and Abies lasiocarpa are reestablishing on the steep sides of site (intensively sampled summer of 1982)
Road Closure: Road is open.

Site #: 71 Elevation: 2300m
District: Hoback Junction Date Abandoned: 8/71
Location: 36 N 114 W Sec. 18 NESE Topographic Map: Noble Basin
Physiography: Flat
Cultural Practice: Seeded, mixture unknown.
Native vegetation types: Abies lasiocarpa/Vaccinium globulare
Site Recovery: Site is revegetated with Bromus inermis and numerous native forbs. Area around the site has been clearcut and the logging road runs through the site.
Road Closure: Road to site is closed.

Site #: 72 Elevation: 2190m
District: Hoback Junction Date Abandoned: 11/64
Location: 37 N 112 W Sec. 22 SWSW Topographic Map: Raspberry Ridge
Physiography: 4-10 % Slope, northwestern aspect.
Cultural Practice: Unknown.
Native vegetation types: Artemisia tridentata-Artemisia cana/Geum triflorum.
Site Recovery: Road runs through the length of the site. Undisturbed portions of the site are revegetated with several Poa and Carex spp. as well as native forbs and Artemisia cana.
Road Closure: Road is open.

Site #: 73 Elevation: 2166m
District: Hoback Junction Date Abandoned: 11/64
Location: 37 N 112 W Sec 29 NENE Topographic Map: Raspberry Ridge
Physiography: Flat.
Cultural Practice: Unknown.
Native vegetation types: Artemisia tridenta/Eriogonum umbellatum
Site Recovery: Site is well revegetated with Artemisia tridentata and native forbs, to the point that a disturbance boundary is difficult to discern (intensively sampled during summer of 1982).
Road Closure: Road is open.

Site #: 74 Elevation: 2205m
District: Hoback Junction Date Abandoned: 8/58
Location: 37 N 112 W Sec. 31 SENE Topographic Map: Raspberry Ridge
Physiography: 2-15 % slope, western aspect.
Cultural Practice: Unknown.
Native vegetation types: Artemisia tridentata/mixed grass-forb.
Site Recovery: Site is very sandy with scattered patches of established vegetation consisting of Bromus inermis, native forbs, Chrysothamnus nauseosus and Artemisia tridentata.
Road Closure: Sites is accessible by foot only, road is closed and has only partially revegetated with tire tracks still visible.

Site #: 75 Elevation: 2067m
District: Hoback Junction Date Abandoned: 11/62
Location: 37 N 113 W Sec. 23 NENE Topographic Map: Raspberry Ridge
Physiography:
Cultural Practice:
Native vegetation types:
Site Recovery: Site was not located.
Road Closure: Unknown.

Site #: 76 Elevation: 2100m
District: Hoback Junction Date Abandoned: 11/63
Location: 37 N 113 W Sec. 25 SENE Topographic Map: Raspberry Ridge
Physiography: 3-12 % slope, western aspect.
Cultural Practice: Unknown.
Native vegetation types: Artemisia cana/mixed grass-forb.
Site Recovery: Site was not recountoured and existing topography has contributed to severe gully erosion. Vegetation on the site is sparse due to heavy clay soil texture and is predominated by Hordeum jubatum, Poa pratensis and Aster chilensis (intensively sampled during summer of 1982).
Road Closure: Site is accessible by foot only.

Site #: 77 Elevation: 2195m
District: Hoback Junction Date Abandoned: 3/54
Location: 37 N 114 W Sec. 23 NWNE Topographic Map: Bondurant
Physiography: Flat.
Cultural Practice: Unknown.
Native vegetation types: Artemisia cana/mixed grass-forb.
Site Recovery: Site is well revegetated with Bromus inermis, Deschampsia caespitosa, Carex spp., native forbs and Artemisia cana. There is a large area of soil subsidence near the road adjacent to the site.
Road Closure: Road is open, runs adjacent to Sandy Marshall Creek.

Site #: 78 Elevation: 2169m
District: Hoback Junction Date Abandoned: 3/71
Location: 38 N 113 W Sec. 9 NWSW Topographic Map: Granite Falls
Physiography: Site covers northern and southern exposures of an 18% slope hill.
Cultural Practice: Seeded, mixture unknown.
Native vegetation types: Artemisia tridentata/mixed forb - Abies lasiocarpa/Pinus contorta mosaic.
Site Recovery: Site is well revegetated with a thick cover of Bromus inermis, Trifolium spp., native forbs and Artemisia tridentata.
Road Closure: Road to site (via Little Jenny Ranch) is opne, site is above the road, adjacent to an allotment fence.

Site #: 79 Elevation: 1975m
District: Hoback Junction Date Abandoned: 6/72
Location: 38 N 114 W Sec. 4 NWNE Topographic Map: Bull Creek
Physiography: 8-10 % slope, southeastern aspect.
Cultural Practice: Seeded, but no record of mixture was available.
Native vegetation types: Artemisia tridentata/Agropyron spicatum.
Site Recovery: Site is predominantly revegetated by Bromus inermis with isolated reestablished native forbs and Artemisia tridentata. Cut bank slope still remains on the site (intensively sampled during summer of 1982).
Road Closure: Road directly to site has been closed and reseeded. Site is located just above the Granite Creek road and is accessible by foot.

Site #: 80 Elevation: 2046m
District: Hoback Junction Date Abandoned: 8/70
Location: 38 N 114 W Sec. 13 NESW Topographic Map: Granite Falls
Physiography: 8-15% slope, southeastern aspect.
Cultural Practice: Seeded, record of mixture used wast not available.
Native vegetation types: Pinus contorta/Abies lasiocarpa with intermittent Artemisia tridentata stands.
Site Recovery: Vegetation is reestablishing in scattered patches due to heavy clay content of soil. Species include Bromus inermis, Agropyron intermedium, Aster foliaceus and annual forbs (intensively sampled during summer of 1982).
Road Closure: Road to site has been closed and reseeded, vegetation is well established. Accessible by foot only.

Site #: 81 Elevation: 1914m
District: Hoback Junction Date Abandoned: 8/66
Location: 38 N 115 W Sec. 3 SENW Topographic Map: Camp Davis
Physiography: 25-33% slopes, southwestern aspect.
Cultural Practice: Seeded, mixture unknown.
Native vegetation types: Pseudostuga menziesii/Populus tremuloides mountain shrubs.
Site Recovery: Site is very rocky and steep, located above the Hoback River. Vegetation is predominantly Agropyron cristatum with Artemisia tridentata, Chrysothomnus nauseosus and Rosa woodsii reestablishing.
Road Closure: Accessible by foot only.

Site #: 82 Elevation: 2014m
District: Hoback Junction Date Abandoned: 8/48
Location: 39 N 114 W Sec. 27 NENE Topographic Map: Bull Creek
Physiography: Flat, located between Little Granite Cr & a steep slope.
Cultural Practice: Unknown.
Native vegetation types: Riparian vegetation Salix spp./Equisetum spp.
Site Recovery: Site is well revegetated with native grasses, Carex species and forbs, to the point that a disturbance boundary is not discernible.
Road Closure: Road is closed and revegetated.

Site #: 83 Elevation: 2000m
District: Hoback Junction Date Abandoned: 7/79
Location: 39 N 114 W Sec. 35 SWSE Topographic Map: Granite Falls
Physiography:
Cultural Practice:
Native vegetation types:
Site Recovery: Site was being used at the time of reconnaissance and was not visited.
Road Closure: Unknown.

Site #: 84/86 Elevation: 2040m
District: Hoback Junction Date Abandoned: 11/70
Location: 39 N 114 W Sec. 36 NENW Topographic Map: Granite Falls
Physiography: 20-25 % slope, southeastern aspect, holes were drilled 15 m. apart, treating this as one site.
Cultural Practice: Seeded, mixture unknown.
Native vegetation types: Artemisia tridentata/mixed forb.
Site Recovery: Site is well revegetated with Bromus inermis along with numerous native forbs, Artemisia tridentata and A. cana.
Road Closure: Road to site is closed, site is accessible by foot from the Granite Creek Road.

Site #: 85 Elevation: 2006m
District: Hoback Junction Date Abandoned: 8/70
Location: 39 N 114 W Sec. 36 SENW Topographic Map: Granite Falls
Physiography: 10-15% slope, southeastern aspect.
Cultural Practice: Seeded, mixture unknown.
Native vegetation types: Artemisia tridentata-mixed forb/Pinus contorta mosaic.
Site Recovery: Site is well revegetated with a diverse cover of native annual and perennial forbs, Artemisia tridentata, A. cana. and Chrysothamnus nauseosus.
Road Closure: Site is located adjacent to the Granite Creek road.

Site #: 87 Elevation: 2405m
District: Hoback Junction Date Abandoned: 9/79
Location: 39 N 117 W Sec 8 NESE Topographic Map: Observation Peak
Physiography: 10-15% slope, northwestern aspect.
Cultural Practice: Seeded with 5 lbs/A each of Bromus inermis, Dactylis glomerata, Phleum pratense and Agropyron intermedium and 1 lb/A of Trifolium hybridum.
Native vegetation types: Mosaic of Artemisia tridentata, Pseudostuga menziesii, Populus tremuloides/mixed forb.
Site Recovery: Site is predominantly Agropyron cristatum, Bromus inermis, Dactylis glomerata and many annual forbs.
Road Closure: Road to site has been closed, recontoured and reseeded. Seeded species are well established.

Site #: 88 Elevation: 2164m
District: Buffalo Date Abandoned: 8/59
Location: 45 N 113 W Sec. 29 NENW Topographic Map: Davis Hill
Physiography: 15% slope, southern aspect.
Cultural Practice: Unknown, apparently recontoured.
Native vegetation types: Artemisia tridentata/Agropyron spicatum/mountain shrub.
Site Recovery: Site is predominantly revegetated with Bromus inermis in conjunction with numerous reestablishing Artemisia tridentata shrubs (intensively sampled during summer of 1982).
Road Closure: Site is above Highway 26/287 and accessible by foot only.

Site #: 89 Elevation: 2629m
District: Pinedale Date Abandoned: 11/70
Location: 36 N 109 W Sec. 29 SWNE Topographic Map: New Fork Lakes
Physiography: Site itself was only a 2 % slope, adjacent south facing slopes are 12-25%.
Cultural Practice: Unknown.
Native vegetation types: Populus tremuloides/Artemisia tridentata/mountain shrub.
Site Recovery: Site is well revegetated with native grasses and perennial forbs.
Road Closure: Road is open.

Site #: 90 Elevation: 2636m
District: Pinedale Date Abandoned: 10/65
Location: 36 N 109 W Sec. 29 SWNE Topographic Map: New Fork Lakes
Physiography: Site is level, adjacent southwestern slope is 10%.
Cultural Practice: Unknown.
Native vegetation types: Artemisia tridentata/Populus tremuloides mosaic.
Site Recovery: Site is predominated by Agropyron cristatum, Poa spp., Bromus inermis, Festuca spp. and several native forbs.
Road Closure: Site is accessible by foot from Site 89.

Site #: 91 Elevation: 2598m
District: Pinedale Date Abandoned: 11/64
Location: 36 N 109 W Sec. 28 SWSE Topographic Map: New Fork Lakes
Physiography: 20-40%, southern aspect.
Cultural Practice: Unknown, apparently recontoured.
Native vegetation types: Populus tremuloides/mixed grass-forb.
Site Recovery: Vegetation on site is patchy and consists of Bromus inermis, several Carex spp., Taraxacum officinale and a variety of native perennial forbs.
Road Closure: Road is open.

APPENDIX D

SUMMARY OF INDIVIDUAL SITE DATA, INTENSIVE ANALYSIS OF 17 ABANDONED DRILL SITES

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APPENDIX D

I. Sagebrush Sites

TABLE 6. Physical parameters and location of each sagebrush site intensively sampled.

Site Number	Age Since Abandonment[1] (Years)	Seeded	Size (ha)	Elevation (meters)	Slope (%)	Aspect	Road Closed	Native Habitat Classification[2]	Native Soil Classification[3]	District	Legal Location	U.S.G.S. Topographic Map
58	3	Yes	.5	2200	0-2	Flat	Yes	*Artemisia tridentata/ Agropyron trachycaulum* community[4]	Aquic Cryofluvent	Gros Ventre	42N 113W Sec. 24 NENW	Upper Slide Lake
30	3	Yes	1.4	2975	0-5	Flat	Yes	*Artemisia tridentata/ Stipa columbiana* community	Typic Cryorthent	Big Piney	35N 115W Sec. 24 SESW	Lookout Mountain
29	12	Yes	2.4	2930	3-8	Flat	Yes	*Artemisia tridentata/ Stipa columbiana* community	Typic Cryorthent	Big Piney	35N 115W Sec. 25 SENW	Lookout Mountain
79	12	Yes	1.2	1975	8-10	Southeast	Yes	*Artemisia tridentata/ Melica spectabolis* community	Argic Cryoboroll	Hoback Junction	38N 114W Sec. 4 NWNE	Bull Creek
46	17	Yes(?)	.7	2660	6-8	South	Yes	*Artemisia tridentata/ Festuca idahoensis*	-	Pinedale	40N 110W Sec. 26 SENE	Mosquito Lake
73	18	Yes(?)	.3	2170	2	Flat	No	*Artemisia tridentata/ Stipa comata*	Argic Cryoboroll	Hoback Junction	37N 112W Sec. 29 NENE	Raspberry Ridge
76	19	No	.3	2100	3-12	Southwest	Yes	*Artemisia tridentata/ Festuca idahoensis*	Argic Cryoboroll	Hoback Junction	37N 113W Sec. 25 SENE	Raspberry Ridge
88	24	No	.4	2160	15	South	Yes	*Artemisia tridentata/ Agropyron spicatum*	-	Buffalo	45N 113W Sec. 29 NENW	Davis Hill
33	33	No	.5	2490	3	Flat	Yes	*Artemisia tridentata/ Stipa comata*	-	Greys River	30N 119W Sec. 9 SWNE	Smoot

1/ In 1982.

2/ Sites not listed as communities were classified into sagebrush habitats as described by Bramble-Brodahl, M.K. 1978. Classification of *Artemisia* vegetation in the Gros Ventre area, Wyoming. M.S. Thesis, Univ. of Idaho, Moscow.

3/ Sites without soil classification have not been mapped by Forest Service soil survey.

4/ Sites designated as communities did not conform to a habitat classification and have been listed according to dominant shrub and grass species occurring in the sampled native vegetation.

APPENDIX D

Site Description Narratives - Sagebrush Sites

Site 58

This site was abandoned in October of 1979 and seeded at that time with a mixture consisting of: Poa pratensis (½ lb/a), Dactylis glomerata (2 lb/a), Agropyron intermedium (2 lb/a), Bromus inermis (1 lb/a), and Melilotus officinalis (½ lb/a). The drill site is located on flat alluvial bottomland approximately 46 meters from the Gros Ventre River (Fig. 11). Undisturbed native vegetation directly west of the site was used for comparative sampling (Fig. 12).

The prevailing climate at this site is characterized by approximately 46-51 cm of annual precipitation and an average growing season of 150 to 180 days. A nighttime freeze is possible at any time throughout the summer. Daytime temperatures can reach as high as 27° C during July and August, with average temperatures in the winter months dropping to a low of -17°C.

Site 30

Site 30 is located on a sagebrush ridgetop overlooking the Green River Valley (Fig. 13). This bench is situated below and to the northeast of both Lookout and Horse Mountains and above the drainages for the South Fork Hoback River and South Beaver Creek. Site 30 was abandoned in September of 1979 and was recontoured and seeded. The seed mixture used was composed of Agropyron spp., Bromus inermis, Phleum pratense, and a Trifolim spp., each seeded at 5 lbs/a. Undisturbed native vegetation east of the site was used for vegetation and soil sampling (Fig. 14).

This area receives approximately 76 cm of precipitation annually with a large portion of this occurring as snow. Due to the open exposure of this ridgeline, it is subject to high winds and cold temperatures. Frost is possible during any night throughout the year and the growing season averages approximately 100 to 120 days, from mid June to mid September.

Site 29

This site is located approximately 1.6 km due south of site 30. It is situated on a ridgetop which slopes gradually to the east and drains into the North Fork of Dry Beaver Creek (Fig. 15). Prevailing climate is similar to that described for site 30. Site 29 was abandoned in August 1971. This site was recontoured and seeded but a record of the seed mixture used was not available. Undisturbed native vegetation located north of the site was used for comparative sampling (Fig. 16).

Site 79

Site 79 is located just above the Granite Creek road, approximately .5 km upstream from the confluence of Granite creek and the Hoback River. This site is located on a gently sloping (8-10%) bench with a southeastern aspect (Fig. 17). Native vegetation located above the site was used for comparative sampling (Fig. 18). The site was abandoned in May, 1970 and was seeded, but no record of the mixture used was available. The area did not appear to have been recontoured because of the cut bank slope still remaining just above the drill pipe and the large amount of rock left on the surface.

Annual precipitation at this site averages approximately 53 cm. The growing season ranges from 120 to 150 days with a night-time freeze possible at any time.

During the initial extensive survey of sites, this area was not identified as having experienced herbicidal sagebrush eradication. Upon visiting the site the second season this oversight was recognized. Forest Service records indicated that 75 hectares along the bench above Granite Creek had been aerially sprayed in strips using a helicopter. This occurred during May and early June of 1973 using 2,4-D. Abandonment of this site had occurred three years prior to this. There were obvious strips of dead sagebrush following the contour of the bench; however, a relatively narrow strip of vegetation above and adjacent to the drill site was apparently unaffected. At the time of field sampling, it was decided to proceed with sampling the disturbed site and confine comparative sampling to the adjacent unsprayed strip of vegetation. However, application of herbicide was later considered to have altered the surrounding native community drastically enough to affect natural reestablishment of native species onto the disturbed site. This negated valid comparison of vegetation data from this site with that of others.

For this reason, the vegetation data reported here were not included in the previous overall discussion of plant community development of sagebrush sites. Soils data from this site were used in overall analysis because results from these soil pits were consistent with results obtained from the other eight sagebrush sites. It was felt that spraying with 2,4-D did not alter soil characteristics enough to warrant discarding these soils data.

Site 46

This site is located approximately 3.2 km due east of Mosquito Lake and was abandoned in October, 1965. The site itself (Fig. 19) is on a southern aspect with a 6-8 % slope. Undisturbed native vegetation located directly north of the site was used for comparative sampling (Fig. 20).

The area appeared to have been recontoured, but it is not known if the site was seeded. However, the presence of Bromus inermis as a substantial component of the disturbed site community and its total

absence from the native site suggested the likelihood that this area had been seeded at the time of abandonment.

Annual precipitation averages approximately 30-35 cm for this area, estimated from data reported by the nearby Pinedale weather station. A normal growing season will begin in late May or mid-June and persist until approximately mid-September, with a duration of 100-120 days. However, nighttime freezes can occur at any time. This site is located on an open hillside without protection from trees or mountains and is subject to prevailing westerly winds.

Site 73

Site 73 is located approximately .5 km south of Highway 189 and about 13 km east of Bondurant. The site occupies a level bench which gradually slopes towards North Fork Creek to the north and Fisherman Creek due south and east (Fig. 21). Undisturbed native vegetation located east of the site was used for comparative sampling (Fig. 22). The site was drilled and subsequently abandoned in October-November, 1964. Due to the level topography of the area and the short duration of drilling activity it is suspected that surface disturbance was confined to minimal excavating and leveling with heavy equipment. There were no records available documenting the use of reclamation practices. However, the site appeared to have been recontoured at the time of abandonment and very likely seeded, as evidenced by the presence of Bromus inermis on the disturbed site and its absence from the undisturbed area sampled.

Average annual precipitation at this site is approximately 79 cm. The normal growing season begins in mid-May and ends in late September or mid-October, a duration of approximately 120-150 days. However, nighttime temperatures can drop below freezing at any time throughout the year.

Site 76

This site is located approximately 3 km due west from site 73 on the south side of Highway 189. Climate affecting this site is similar to that described for site 73. This area is characterized by rolling hills covered with sagebrush/grass vegetation and dissected by several creeks and their tributaries. The drill site itself is located on a west facing bench, with a gentle slope of 3-12 percent overlooking South Fork Creek (Fig. 23). Undisturbed native vegetation located directly above the site was used for comparative sampling (Fig. 24). This operation was abandoned in November of 1963. There were no records kept on abandonment procedures pertaining to reclamation; however, the site did not appear to have been recontoured or seeded. Since abandonment, rain and snowfall runoff have been collecting on the site and subsequently running off the toe of the slope, creating a large actively eroding gully. Water accumulating on the surface has apparently prevented the establishment of an extensive vegetative cover.

Site 88

Site 88 is the northernmost abandoned site in the forest. It is located on a south facing aspect with a 15 % slope (Fig. 25). The site is located directly above and due north of Highway 26/287 approximately .3 km east of Lava Creek campground. Undisturbed native vegetation located directly above the site was used for comparative sampling (Fig. 26). This site was abandoned in August, 1958. No documentation was available concerning reclamation practices applied to this site at the time of abandonment. However, personal communication with a long-time permittee on the allotment this site is located within revealed that the site had been recontoured, but was probably not seeded. The presence of a dense cover of Bromus inermis on the disturbed site can only be attributable to seed being introduced by grazing cattle or some other means.

Average annual precipitation received at this site is approximately 58 cm. Frost free days average 39 for this area, indicating a somewhat longer growing season than found at other sites sampled.

Site 33

This site is located approximately 10 km south of the town of Fairview. Site 33 is located on a shale ridge, which overlooks Spring Creek to the west and is bordered by First Creek drainages to the north and Second Creek to the southeast. The site itself is level with only a 3 % slope and a slightly southeastern aspect (Fig. 27). Undisturbed native vegetation located above and east of the site was used for comparative sampling (Fig. 28). This well was abandoned in October of 1949. Apparently, this site was neither recontoured or seeded. A cutbank slope is still present on the eastern side of the site, and the site is quite compacted with large quantities of rock on both the upper surface and toe of the slope. There is also a depression essentially devoid of vegetation on the western edge which appeared to be the remains of the drilling fluid storage pit.

This area receives approximately 56 cm of precipitation annually. Peak precipitation usually occurs in May and June before dropping to a minimum in July, August and September. An average of 100 inches of snowfall can be expected during the winter months (Alyea, 1969). Average frost free days are estimated to be 21. The growing season at this site is generally about 120 days, beginning in late May and extending through mid to late September. However, nighttime temperatures can drop below freezing at any time throughout the year.

APPENDIX D

Photographs of Sagebrush Disturbances and Associated Native Vegetation

FIGURE 11
SITE 58 - REFERENCE PHOTO TAKEN FROM THE WESTERN EDGE OF THE SITE. DATE 7-8-82.

FIGURE 12
SITE 58 - VIEW OF ADJACENT NATIVE VEGETATION, LOCATED WEST OF THE SITE, USED FOR UNDISTURBED SAMPLING. DATE 7-7-82.

FIGURE 13
SITE 30 - REFERENCE PHOTO TAKEN FROM ROAD LEADING TO THE SITE, DRILL PIPE IS 40° EAST OF PHOTO POINT. DATE 8-22-82.

FIGURE 14
SITE 30 - VIEW OF ADJACENT NATIVE COMMUNITY USED FOR UNDISTURBED SAMPLING, LOCATED EAST OF SITE. DATE 8-22-82.

FIGURE 15
SITE 29 - REFERENCE PHOTO TAKEN FROM HILL OVERLOOKING THE SITE, DRILL PIPE IS 100° EAST OF PHOTO POINT. DATE 8-21-82.

FIGURE 16
SITE 29 - VIEW OF ADJACENT NATIVE COMMUNITY, LOCATED NORTH OF SITE, USED FOR UNDISTURBED SAMPLING. DATE 8-21-82.

FIGURE 17
SITE 79 - REFERENCE PHOTO TAKEN FROM SOUTHWESTERN EDGE OF SLOPE ABOVE SITE, DRILL PIPE IS 80° EAST OF PHOTO POINT. DATE 6-12-82.

FIGURE 18
SITE 79 - VIEW OF ADJACENT NATIVE COMMUNITY, LOCATED NORTH OF SITE, USED FOR UNDISTURBED SAMPLING. DATE 5-29-82.

FIGURE 19
SITE 46 - REFERENCE PHOTO TAKEN FROM NORTHERN EDGE OF SITE, DRILL PIPE IS 188° SOUTH OF PHOTO POINT. DATE 7-22-82.

FIGURE 20
SITE 46 - VIEW OF ADJACENT NATIVE COMMUNITY, LOCATED NORTH OF SITE, USED FOR UNDISTURBED SAMPLING. DATE 7-22-82.

FIGURE 21
SITE 73 - REFERENCE PHOTO TAKEN FROM SLOPE ABOVE SITE, PIPE LOCATED AT 110° EAST OF PHOTO POINT. DATE 6-27-82.

FIGURE 22
SITE 73 - VIEW OF ADJACENT NATIVE COMMUNITY, USED FOR UNDISTURBED SAMPLING, LOCATED EAST OF SITE. DATE 6-26-82.

FIGURE 23
SITE 76 - REFERENCE PHOTO TAKEN FROM SLOPE ABOVE SITE.
DATE 6-20-81.

FIGURE 24
SITE 76 - VIEW OF ADJACENT NATIVE COMMUNITY, LOCATED ABOVE THE SITE, USED FOR UNDISTURBED SAMPLING. DATE 6-20-81

FIGURE 25
SITE 88 - REFERENCE PHOTO TAKEN FROM NORTHEASTERN EDGE OF SITE, DRILL PIPE IS 224° SOUTHWEST OF PHOTO POINT. DATE 6-29-82.

FIGURE 26
SITE 88 - VIEW OF ADJACENT NATIVE COMMUNITY, LOCATED ABOVE SITE, USED FOR UNDISTURBED SAMPLING. DATE 6-29-82.

FIGURE 27
SITE 33 - REFERENCE PHOTO TAKEN FROM HILLTOP ON NORTHERN END OF SITE. DATE 7-14-82.

FIGURE 28
SITE 33 - VIEW OF ADJACENT NATIVE COMMUNITY, USED FOR UNDISTURBED SAMPLING, LOCATED EAST OF SITE. DATE 7-14-82.

TABLE 7. Mean estimated (%) plant class canopy cover, ground cover and species canopy cover for all sagebrush sites, 1982.

Data for Sagebrush Sites

	Site 58		Site 30		Site 29		Site 79		Site 46		Site 73		Site 76		Site 88		Site 33	
	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site
A. PLANT CLASS[1/]																		
Total Vegetation	18.2[b2/]	49.0[a]	43.2[b]	64.4[a]	34.8[b]	63.1[a]	42.2[a]	42.4[a]	55.1[b]	66.0[a]	29.4[b]	47.8[a]	23.1[b]	50.5[a]	48.4[b]	61.8[a]	20.5[b]	66.0[a]
Perennial Grasses and Grasslikes	15.2[a]	13.2[a]	35.6[a]	20.2[b]	30.2[a]	23.4[b]	26.0[a]	9.8[b]	15.3[b]	23.7[a]	3.7[b]	9.9[a]	5.0[b]	19.8[a]	34.8[a]	20.4[b]	5.6[b]	14.8[a]
Perennial Forbs	1.2[b]	27.4[a]	3.6[b]	27.3[a]	3.9[b]	32.1[a]	4.1[b]	14.3[a]	32.8[a]	32.4[a]	4.6[b]	7.2[a]	16.3[a]	9.1[b]	6.2[b]	15.4[b]	7.7[b]	31.3[a]
Annual Forbs	.5[b]	2.4[a]	4.1	0	1.9[a]	.3[b]	T [a]	.5[a]	1.3[a]	.1[b]	1.0[b]	2.6[a]	1.5[a]	1.5[a]	0	.6	.5[b]	4.8[a]
Leguminous Forbs	1.4[a]	1.7[a]	.5[b]	1.4[a]	T [b]	1.0[a]	.1[a]	.3[a]	1.3[a]	2.0[a]	3.4[a]	4.1[a]	.2[b]	1.9[a]	1.6[a]	1.2[a]	.2[b]	3.8[a]
Shrubs	.2[b]	8.5[a]	.1[b]	27.9[a]	0	21.4	T [b]	16.2[a]	6.9[b]	15.9[a]	16.7[b]	28.4[a]	.7[b]	20.7[a]	6.5[b]	41.8[a]	9.1[b]	23.0[a]
B. INDIVIDUAL PLANT SPECIES																		
1. Perennial Grasses & Grasslikes																		
Agropyron albicans	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	T	-
Agropyron caninum	-	-	-	-	-	-	-	-	-	-	-	.5	-	-	-	-	-	-
Agropyron cristatum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0	-	.9	-
Agropyron dasystachyum	-	-	-	-	-	-	-	-	-	-	.2	-	-	-	-	-	-	-
Agropyron intermedium	T[3/]	-	2.0	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0	-
Agropyron smithii	-	-	-	-	-	-	T	-	-	-	.1	-	.6	-	-	-	-	-
Agropyron spicatum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9.3	-	-
Agropyron trachycaulum	-	3.7	9.5	3.4	1.3	8.6	-	1.0	1.2	4.1	-	-	-	1.6	-	.4	-	3.0
Agrostis exarata	-	-	-	-	-	-	-	-	-	-	-	-	-	.4	-	-	-	-
Bromus inermis	1.5	.1	6.6	-	13.7	-	25.8	-	3.4	-	1.2	-	.1	-	23.6	-	.1	-
Bromus marginatus	.1	-	-	-	.1	.1	-	-	-	-	-	.1	-	-	1.2	.1	-	2.7
Bromus spp.	-	-	-	-	-	-	-	1.0	-	-	-	-	-	-	-	-	-	-
Dactylis glomerata	11.6	-	10.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Danthonia intermedia	T	-	-	-	-	-	-	-	-	.6	-	-	-	-	-	-	-	-
Deschampsia caespitosa	-	-	-	-	7.2	-	-	-	4.8	-	-	-	-	-	-	-	-	-
Elymus cinereus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.6	-	-
Elymus glaucus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.1
Festuca arundinacea	2.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Festuca idahoensis	-	.2	-	-	-	-	-	.9	3.2	12.4	-	2.6	.8	12.1	-	-	-	-
Hesperachloa kingii	-	-	.2	1.8	-	1.4	-	-	-	-	-	-	-	-	-	-	1.6	4.4
Hordeum brachyantherum	-	-	-	-	4.2	-	-	-	.5	.1	-	-	-	-	-	-	-	-
Hordeum jubatum	-	-	-	-	-	-	-	-	-	-	-	-	1.4	-	-	-	-	-
Koeleria cristata	-	2.5	-	-	-	-	-	.4	-	1.4	1.0	1.0	-	2.1	-	2.9	.1	1.7
Melica spectabolis	-	-	-	-	-	T	-	4.6	-	.2	-	-	-	-	-	-	-	-
Muhlenbergia porteri	-	2.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Muhlenbergia spp.	-	-	-	-	.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Oryzopsis hymenoides	.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phleum alpinum	-	-	-	-	.4	.1	-	-	.1	-	-	-	-	-	-	-	-	-
Phleum pratense	-	-	6.3	-	.2	-	-	-	T	-	-	-	-	-	-	-	-	-
Poa canbyi	-	-	.8	.4	1.0	.6	-	-	-	-	-	-	-	.4	.2	-	-	-

TABLE 7 (cont.):

	Site 58		Site 30		Site 29		Site 79		Site 46		Site 73		Site 76		Site 88		Site 33	
	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site
B. INDIVIDUAL PLANT SPECIES - Cont.																		
1. Perennial Grasses & Grasslikes - Cont.																		
Poa curta	.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Poa cusickii	-	-	-	-	-	-	-	-	-	-	-	.1	-	.1	-	1.1	-	-
Poa fendleriana	-	1.0	-	.6	-	.3	-	-	-	-	-	-	-	.4	-	5.5	.2	-
Poa grayana	-	-	-	.9	-	.5	-	-	-	-	-	-	-	-	-	-	-	-
Poa juncifolia	-	-	-	4.1	-	2.6	-	-	-	-	-	-	-	-	-	-	-	-
Poa palustris	-	.3	-	-	-	-	-	.8	.5	.5	-	1.0	-	1.0	-	-	.2	1.3
Poa pattersonii	-	-	1.8	.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Poa pratensis	.5	1.0	-	-	1.2	.2	.3	.1	.4	-	-	.3	2.0	T	7.2	.8	1.4	.2
Poa sandbergii	.2	1.2	-	-	-	-	-	-	.2	-	-	-	-	-	-	-	-	-
Sitanion hystrix	-	-	-	-	-	-	-	-	-	-	-	-	.4	-	-	-	.1	-
Stipa columbiana	-	-	-	3.8	-	5.9	-	-	.1	.3	-	-	-	-	-	-	-	-
Stipa comata	-	.2	-	-	-	-	-	-	-	.2	-	4.1	T	-	-	-	-	-
Stipa lettermanii	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.5	.2
Stipa spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	.4	-	-	-	-
Trisetum spicatum	-	-	.3	.1	.1	.4	-	-	.1	-	-	-	-	-	-	-	-	.1
Unknown grass	-	-	-	-	-	.1	-	-	-	.8	-	-	-	-	-	-	-	-
Carex eleocharis	-	1.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carex filifolia	-	-	-	-	-	-	-	-	.3	.2	-	-	-	-	-	-	-	-
Carex hellophila	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.3	.6	-	-
Carex hoodii	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.4
Carex microptera	-	-	-	-	1.5	.7	-	-	1.1	-	-	-	-	-	.1	-	-	-
Carex phaeocephala	-	-	-	5.3	-	1.9	-	-	-	.6	-	-	-	-	-	-	-	-
Carex rossii	-	-	-	-	-	-	-	.2	-	-	-	-	-	-	-	-	-	-
Carex spp.	-	-	-	-	.2	T	-	-	-	-	.2	3.2	-	1.7	-	-	-	-
Juncus balticus	-	.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Juncus longistylus	-	.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Juncus nevadensis	-	-	-	-	-	-	-	-	.6	1.4	-	-	-	-	-	-	-	-
Scirpus spp.	-	-	-	-	-	-	-	-	.8	-	-	-	-	-	-	-	-	-
Summed Cover	16.8	15.5	38.1	20.7	31.2	23.4	26.1	9.0	17.3	22.8	2.7	12.9	5.3	20.2	33.6	21.3	6.1	15.1
2. Perennial Forbs																		
Achillea millefolium	-	.3	2.0	2.2	1.1	4.5	.9	1.5	1.3	1.7	T	-	.5	1.4	.1	-	.3	2.0
Agoseris spp.	T	T	-	-	T	.1	-	-	T	-	-	T	-	-	T	-	T	.3
Allium acuminatum	-	-	-	-	-	-	-	-	-	-	.1	.5	-	-	-	-	-	-
Allium spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	T
Antennaria anaphaloides	-	-	-	-	-	-	-	-	-	T	-	-	-	-	-	-	-	-

TABLE 7 (cont.):

	Site 58		Site 30		Site 29		Site 79		Site 46		Site 73		Site 76		Site 88		Site 33	
	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site
B. INDIVIDUAL PLANT SPECIES - Cont.																		
2. Perennial Forbs - Cont.																		
Antennaria dimorpha	.1	-	-	-	-	-	-	-	-	-	.1	-	-	-	-	.8	-	-
Antennaria microphylla	-	8.3	-	2.5	-	.1	-	T	.5	4.8	-	.2	-	3.1	-	1.0	.1	.5
Aquilegia flavescens	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.3
Arabis spp.	T	.5	-	.8	-	-	T	.1	-	T	T	.1	-	-	-	-	.1	.2
Arenaria congesta	-	.2	-	1.5	-	-	-	.1	-	2.8	-	.2	-	.1	-	-	T	1.5
Aster chilensis	T	2.3	-	-	.4	-	1.7	2.8	-	-	.8	-	14.1	1.8	3.2	3.3	-	-
Aster spp.	.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Balsamorhiza sagittata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.1	.2	-
Bessia wyomingensis	-	-	-	-	-	-	-	-	-	-	-	-	-	.1	-	-	-	-
Borage spp.	-	-	-	.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Castelleja sulphurea	-	-	-	-	-	.6	-	-	-	-	-	-	-	-	-	-	-	-
Castelleja spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.2	-
Cerastrium spp.	-	.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chaenactis spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.5	-
Circium spp.	-	.1	-	-	-	-	.1	-	1.4	.2	-	-	.6	-	1.4	-	.3	-
Claytonia lanceolata	-	-	-	-	-	-	-	-	-	-	-	T	-	T	-	-	-	-
Clematis hirsutissima	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.1
Comandra umbellata	-	1.3	-	-	-	-	-	-	-	-	-	.1	-	-	-	.3	-	-
Crepis atrabarba	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.2
Crepis spp.	-	-	-	-	-	T	T	.1	-	-	-	-	-	-	-	-	-	-
Delphinium bicolor	-	-	-	-	-	-	-	.4	-	-	-	-	-	-	-	-	-	-
Delphinium nuttalli	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.2
Delphinium occidentale	-	-	-	-	-	.3	-	-	-	-	-	-	-	-	-	-	-	-
Epilobium angustifolium	-	-	-	-	-	-	-	-	-	.3	-	-	-	-	-	-	-	-
Erigeron caespitosus	-	2.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Erigeron compositus	-	.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Erigeron pumilus	-	T	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Erigeron speciosus	-	-	-	.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Erigeron spp.	-	-	-	-	-	.1	-	-	.4	1.6	T	-	-	-	-	-	.8	.3
Eriogonum umbellatum	-	.7	-	9.4	-	3.1	-	5.1	-	2.5	.3	5.6	-	.4	-	6.0	2.1	.9
Fragaria virginiana	-	2.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Frasera speciosa	-	-	-	-	-	1.2	-	-	-	1.6	-	-	-	-	-	-	-	-
Geranium richardsonii	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.0
Geranium viscosissimum	.1	-	-	-	-	2.1	-	-	-	7.9	-	-	-	-	1.1	.2	-	-
Geum triflorum	-	-	-	7.3	-	-	-	-	.2	6.6	-	-	-	-	-	-	-	.1
Gilia aggregata	-	.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Haplopappus acaulis	-	.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE 7 (cont.):

	Site 58		Site 30		Site 29		Site 79		Site 46		Site 73		Site 76		Site 88		Site 33	
	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site
B. INDIVIDUAL PLANT SPECIES - Cont.																		
2. Perennial Forbs - Cont.																		
Helenium hoopesii	-	-	-	-	-	5.4	-	-	4.5	.2	-	-	-	-	-	-	-	-
Hollanthela uniflora	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.2	3.5
Ligusticum filicinum	-	-	-	-	-	.6	-	-	-	-	-	-	-	-	-	-	-	-
Linum lewisii	-	-	-	-	-	-	-	T	-	.1	-	-	-	-	-	-	-	-
Lithophragma bulbifera	-	-	-	-	-	-	-	-	-	-	-	.3	-	.3	-	-	-	-
Lithophragma parviflora	-	-	-	-	-	-	.1	.1	.1	-	-	-	-	-	-	-	-	-
Lomatium foeniculaceum	.5	4.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lomatium simplex	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.4
Macaranthera canescens	-	.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mertensia longiflora	-	-	-	-	-	-	-	-	-	-	.1	-	-	-	-	-	-	-
Mertensia oblongifolia	-	-	-	-	-	-	-	-	-	-	-	-	-	.3	-	-	-	-
Mertensia spp.	-	-	-	-	-	.1	-	-	-	-	-	-	-	-	-	-	-	-
Microseris spp.	-	.1	-	-	-	-	-	-	-	-	.1	-	-	-	-	-	-	-
Myosotis spp.	-	-	-	-	-	-	-	-	-	.1	-	-	-	-	-	-	-	-
Oenothera spp.	-	-	-	-	-	-	-	-	-	-	-	-	.1	-	-	-	-	-
Orogenia linearifolia	-	-	-	-	-	-	-	.1	-	-	-	-	-	.3	-	-	-	-
Orthocarpos luteus	-	1.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Osmorhiza chilensis	-	-	-	-	-	.1	T	-	-	-	-	-	-	-	-	-	-	-
Pedicularis spp.	-	-	-	-	-	-	-	-	-	.5	-	-	-	-	-	-	-	-
Penstemon humilus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.2	.1
Penstemon spp.	-	-	-	-	-	.2	-	-	.1	-	-	-	-	-	.1	-	-	-
Perideridia gairdneri	-	-	-	-	-	-	-	-	T	-	-	-	-	-	-	-	-	-
Phacelia sericeus	-	-	.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phlox hoodii	-	-	-	.6	-	.6	-	-	-	-	-	.2	-	.7	-	2.6	-	-
Phlox longifolia	-	-	-	-	-	-	-	-	-	2.6	-	-	-	-	-	-	-	1.2
Plantago tweedyi	-	-	-	-	1.3	.1	-	-	-	-	-	-	-	-	-	-	-	-
Potentilla gracilis	T	-	.1	1.2	-	6.4	-	.3	4.1	1.9	-	-	-	-	-	-	-	2.7
Potentilla spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	T	-	-	-	-
Rumex salicifolius	-	.1	.1	-	.1	.2	-	1.3	.2	.8	-	.1	-	-	-	-	-	-
Rumex spp.	-	-	-	-	-	-	-	-	-	-	T	-	-	.3	-	-	-	T
Sedum stenopetalum	T	2.2	-	-	-	-	-	-	-	-	.1	.4	-	-	-	-	-	.1
Senecio dimorphophyllus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	T	1.1	-
Senecio integerrimus	-	.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.3
Senecio spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.3
Sisyrinchium angustifolium	-	.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Solidago canadensis	-	-	-	-	-	-	-	-	.1	-	-	-	-	-	-	-	2.6	3.0
Solidago spp.	-	-	-	-	-	2.4	-	-	-	-	-	-	-	-	-	-	-	.4
Stellaria jamesiana	-	-	.4	1.8	-	2.0	-	-	-	-	-	-	-	-	-	-	-	6.3
Taraxacum officinale	.3	.8	.4	.1	.7	.3	.5	1.3	18.1	.5	4.0	T	1.4	.2	T	-	.2	.1

TABLE 7 (cont.):

	Site 58		Site 30		Site 29		Site 79		Site 46		Site 73		Site 76		Site 88		Site 33	
	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site
B. INDIVIDUAL PLANT SPECIES - Cont.																		
2. Perennial Forbs - Cont.																		
Thalictrum occidentale	-	-	-	-	-	-	-	-	-	.5	-	-	-	-	-	-	-	-
Tragopogon dubius	-	-	-	-	-	-	.3	-	-	-	-	-	-	-	-	-	-	-
Trillius laxus	-	.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Valeriana spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.6
Viola adunca	-	-	-	-	-	-	-	-	-	1.5	-	-	-	-	-	-	-	T
Viola nuttallii	-	-	-	-	-	-	-	1.4	-	-	T	T	-	-	-	-	-	3.3
Viola purpurea	-	-	-	-	-	-	-	-	-	-	.1	T	-	-	-	-	.1	-
Viola spp.	-	.7	-	.1	-	1.2	-	T	-	-	-	-	-	.2	-	.6	.1	-
Perennial #1	-	-	-	-	-	-	.3	T	-	-	.6	.2	-	T	-	-	-	-
Perennial #3	-	-	-	-	-	-	1.0	-	-	-	-	-	-	-	-	-	-	-
Perennial #4	-	-	-	-	-	-	-	T	-	-	-	-	-	-	-	-	-	-
Perennial #6	-	-	-	-	-	-	-	.2	-	-	-	-	-	-	-	-	-	-
Perennial #8	-	-	-	-	-	-	-	T	-	-	-	-	-	-	-	-	-	-
Perennial #9	-	-	-	-	-	-	-	.4	-	-	-	-	-	-	-	-	-	-
Perennial #10	-	-	-	-	-	-	-	.2	-	-	-	-	-	-	.1	-	-	-
Perennial #12	-	-	-	-	-	-	-	.1	-	-	-	-	-	-	-	-	-	-
Perennial #14	-	.3	-	-	-	-	-	-	-	-	-	-	-	.1	-	-	-	T
Perennial #15	-	.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Perennial #16	-	.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Perennial #18	-	.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Perennial #23	-	-	-	-	-	1.3	-	-	-	-	-	-	-	-	-	.5	-	-
Perennial #24	-	-	-	-	-	-	-	-	.4	-	-	-	-	-	-	-	-	-
Perennial #30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	T	-	-
Perennial #31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.1	-	-
Perennial #32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.3	.1
Perennial #33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.7
Perennial #36	-	-	-	-	-	-	-	-	-	.3	-	-	-	-	-	-	-	-
Perennial #40	-	-	-	-	-	.2	-	-	-	-	-	-	-	-	-	-	-	-
Perennial #41	-	-	-	-	-	T	-	-	-	-	-	-	-	-	-	-	-	-
Perennial #42	-	-	-	-	-	.1	-	-	-	-	-	-	-	-	-	-	-	-
Perennial #43	-	-	-	-	-	.1	-	-	-	-	-	-	-	-	-	-	-	-
Summed Cover	1.1	31.2	3.5	27.7	3.6	33.5	4.9	15.5	31.4	39.0	6.3	7.9	16.7	9.3	6.0	15.5	9.4	38.7

TABLE 7 (cont.):

	Site 58		Site 30		Site 29		Site 79		Site 46		Site 73		Site 76		Site 88		Site 33	
	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site
B. INDIVIDUAL PLANT SPECIES - Cont.																		
3. Annual Forbs																		
Androsace septentrionalis	-	.1	T	-	-	T	-	.1	-	T	-	-	T	.3	-	-	-	-
Borage spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	T	-
Capsella bursa-pastoris	T	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chenopodium album	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	T
Collinsia parviflora	-	.1	-	-	-	-	-	-	T	-	-	-	-	T	-	-	-	.3
Collomia linearis	.4	-	-	-	-	-	-	-	.1	-	T	-	-	-	-	-	.1	1.5
Cordylanthus ramosus	-	.5	-	-	-	-	-	-	-	-	-	-	-	-	-	.5	-	-
Cruciferae spp.	-	-	-	-	-	-	-	-	T	-	-	-	-	-	-	-	.2	T
Descurainia spp.	-	-	-	-	-	T	-	-	-	-	-	-	-	-	-	-	-	-
Draba spp.	-	.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Epilobium paniculatum	-	.5	-	-	.8	-	-	-	.1	.1	.2	-	-	.6	-	-	-	-
Gallium biflorum	-	-	-	-	-	.2	-	-	T	-	-	-	-	-	-	-	.1	1.7
Gayophytum diffusum	-	-	-	-	T	-	T	.2	-	-	.4	.4	1.3	.3	-	T	-	-
Lepidium campestre	.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lepidium spp.	-	-	-	-	-	-	-	-	-	-	T	-	-	-	-	-	-	-
Linanthus harknessii	T	.7	-	-	-	-	-	-	T	T	.7	2.4	-	.1	-	-	-	-
Nemophila breviflora	-	-	-	-	-	-	-	.2	-	-	-	-	-	-	-	-	.1	1.2
Orthocarpus tolmiei	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.1	-
Polygonum confertiflorum	-	-	-	-	-	-	-	-	.3	-	-	-	-	-	-	-	-	-
Polygonum douglasii	T	.3	3.6	-	.8	T	-	-	.5	-	-	-	-	-	-	-	T	.2
Polygonum spp.	T	-	-	-	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-
Veronica biloba	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	T	.2
Annual #4	-	-	-	-	-	-	-	-	-	-	-	-	-	T	-	-	-	-
Annual #5	-	-	-	-	-	-	-	-	-	-	-	-	-	.5	-	-	-	-
Annual #6	T	-	-	-	-	-	-	-	-	-	-	-	-	T	-	-	-	-
Annual #7	.3	-	-	-	-	-	-	-	-	-	-	-	-	T	-	-	-	-
Annual #9	-	-	-	-	-	-	-	-	T	-	-	-	-	-	-	-	-	-
Annual #10	-	T	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Annual #13	-	-	-	-	-	-	-	-	.2	-	-	-	-	-	-	-	-	-
Annual #15	-	-	-	-	-	-	-	-	-	-	-	-	-	.4	-	-	-	-
Annual #35	-	-	-	-	-	-	-	-	T	-	-	-	-	-	-	-	-	-
Summed Cover	.8	2.3	3.6	0	2.8	.2	-	.5	1.2	.1	1.3	2.8	1.3	2.2	-	.5	.6	5.1

TABLE 7 (cont.):

	Site 58		Site 30		Site 29		Site 79		Site 46		Site 73		Site 76		Site 88		Site 33	
	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site
B. INDIVIDUAL PLANT SPECIES - Cont.																		
4. Leguminous Forbs																		
Astragalus miser	.1	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Astragalus spicatus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.2	.6
Astragalus spp. #1	-	.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Astragalus spp. #2	-	.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Astragalus spp. #3	.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lupinus argenteus	-	-	-	-	-	.4	-	-	.6	1.9	-	-	-	-	-	1.0	-	-
Lupinus caudatus	-	-	-	-	-	-	-	-	-	-	-	-	-	1.4	-	-	-	-
Lupinus lepidus	-	-	.1	.1	-	-	-	-	.2	-	-	-	-	-	-	-	-	-
Lupinus leucophyllus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.0
Lupinus sericeus	-	-	-	-	-	-	.1	.3	-	-	3.4	3.8	-	-	1.6	-	-	-
Lupinus wyethia	-	T	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oxytropis spp.	-	.1	-	-	-	-	-	-	-	-	-	-	-	-	T	.2	-	-
Trifolium gymnocarpon	-	-	-	1.4	-	-	-	-	-	-	-	-	.2	.5	-	-	-	1.8
Trifolium longipes	-	-	.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trifolium pratense	-	-	-	-	T	-	-	-	-	-	-	-	-	-	-	-	-	-
Trifolium repens	1.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trifolium spp.	-	-	-	-	-	.6	-	-	.6	.2	-	-	-	-	-	-	T	-
Summed Cover	1.3	1.6	.6	1.5	-	1.0	.1	.3	1.4	2.1	3.4	3.8	.2	1.9	1.6	1.2	.2	4.4

TABLE 7 (cont.):

	Site 58		Site 30		Site 29		Site 79		Site 46		Site 73		Site 76		Site 88		Site 33	
	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site
B. INDIVIDUAL PLANT SPECIES - Cont.																		
5. Shrubs																		
Amelanchier alnifolia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.1	T	-
Artemisia arbuscula	-	-	-	-	-	-	-	-	-	-	-	-	-	6.7	-	-	-	-
Artemisia cana	-	-	-	-	-	-	-	-	5.6	5.3	-	-	.1	3.9	-	-	-	-
Artemisia tridentata var. vaseyana	.3	5.0	.1	28.1	-	21.7	.1	15.9	1.2	7.8	14.8	28.4	.7	10.5	6.4	37.2	4.4	16.1
Chrysothamnus nauseosus	-	-	-	-	-	-	-	-	-	-	1.1	-	-	-	-	2.1	-	-
Chrysothamnus viscidiflorus	-	.1	-	-	-	-	-	-	-	-	-	.1	-	.2	-	.4	3.6	2.8
Potentilla fruticosa	-	.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ribes spp.	-	-	-	-	-	T	-	-	-	-	-	-	-	-	-	-	-	-
Rosa woodsii	-	3.3	-	-	-	-	-	-	-	-	-	-	-	-	.1	-	-	-
Salix spp.	-	-	-	-	-	-	-	-	.1	-	-	-	-	-	-	-	-	-
Symphoricarpos spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.2	2.4	1.6	6.2
Tetradymia canescens	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	T	-	-
Summed Cover	.3	9.2	.1	28.1	-	21.7	.1	15.9	6.9	13.1	15.9	28.5	.8	21.3	6.7	42.2	9.6	25.1
6. TOTAL SUMMED COVER	20.3	59.8	45.9	78.0	37.6	79.9	31.2	41.2	58.2	77.1	29.6	55.9	24.3	54.9	47.9	80.7	25.9	88.4
C. GROUND COVER																		
Bareground	80.6^a	28.2^b	37.5^a	16.2^b	30.5^a	21.2^b	42.3^a	7.9^b	39.7^a	14.8^b	55.6^a	32.4^b	70.1^a	17.7^b	15.9^a	17.2^a	71.0^a	25.6^b
Litter	11.3^b	40.6^a	44.8^b	63.3^a	48.0^b	57.6^a	46.9^b	79.1^a	30.6^b	57.7^a	36.6^a	51.8^a	19.4^b	58.7^a	63.2^a	61.4^a	21.9^b	50.7^a
Moss/Lichen	0	6.9	0	0	6.0	0	$.3^a$	$.3^a$	5.8^a	$.1^b$	1.2^a	$.5^a$	0	4.1	0	.2	0	.1
Basal Stems	8.1^b	24.3^a	17.7^a	20.5^a	15.5^b	21.2^a	10.5^a	12.7^a	23.9^a	27.4^a	6.6^b	15.3^a	10.5^b	19.5^a	20.9^a	21.2^a	7.1^b	23.6^a
Small Rocks (< 2 cm)	11.9^a	$.3^b$	6.1^a	2.3^b	3.6^a	1.2^b	13.8^a	$.8^b$	4.0^a	1.8^b	12.4^a	5.0^b	1.5^a	$.1^b$	$.4^b$	1.2^a	27.2^a	$.6^b$
Medium Rocks (2-30 cm)	19.9^a	$.4^b$	13.6^a	2.8^b	12.0^a	2.0^b	24.3^a	1.4^b	3.5^a	5.0^a	21.4^a	8.8^b	$.5^a$	$.4^a$	$.6^a$	$.9^a$	22.8^a	1.5^b
Large Rocks (>30 cm)	0	0	0	0	0	0	0	0	0	1.5	0	0	0	0	0	0	$.6^a$	$.2^a$

1/ Independently estimated; i.e., not summed parameters.

2/ Values between disturbed-native pairs followed by same letter not significantly different at the .05 level (t-test).

3/ T = trace; i.e., less than 0.1 percent.

TABLE 8. Frequency of occurence for plant classes, species and ground cover on all sagebrush sites, 1982.

	Site 58		Site 30		Site 29		Site 79		Site 46		Site 73		Site 76		Site 88		Site 33	
	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site
A. PLANT CLASS[1/]																		
Total Vegetation	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	97.5	100
Perennial Grasses and Grasslikes	100	100	100	100	100	100	100	100	97.5	100	97.5	100	85	100	100	100	90	100
Perennial Forbs	35.0	100	62.5	100	60	100	90	97.5	100	97.5	100	97.5	100	95	57.5	100	92.5	100
Annual Forbs	55.0	87.5	70	0	85	17.5	12.5	47.5	65	22.5	97.5	95	97.5	92.5	0	25	25	62.5
Leguminous Forbs	32.5	57.5	12.5	45	2.5	22.5	5	32.5	45	45	65	77.5	7.5	52.5	45	35	10	72.5
Shrubs	10.0	90	2.5	90	0	82.5	2.5	9.5	67.5	90	100	100	12.5	100	52.5	100	60	92.5
B. INDIVIDUAL PLANT SPECIES																		
1. Perennial Grasses & Grasslikes																		
Agropyron albicans	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-
Agropyron caninum	-	-	-	-	-	-	-	-	-	-	-	30	-	-	-	-	-	-
Agropyron cristatum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.5	-	37.5	-
Agropyron dasystachyum	-	-	-	-	-	-	-	-	-	-	7.5	-	-	-	-	-	-	-
Agropyron intermedium	2.5	-	37.5	-	-	-	-	-	-	-	-	-	-	-	-	-	25	-
Agropyron smithii	-	-	-	-	-	-	2.5	-	-	-	2.5	-	17.5	-	-	-	-	-
Agropyron spicatum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	92.5	-	-
Agropyron trachycaulum	-	87.5	80	75	32.5	82.5	-	65	10	87.5	-	-	-	67.5	-	17.5	-	70
Agrostis exarata	-	-	-	-	-	-	-	-	-	-	-	-	-	10	-	-	-	-
Bromus inermis	40.0	5	72.5	-	92.5	-	100	-	67.5	-	72.5	-	2.5	-	97.5	-	2.5	-
Bromus marginatus	12.5	-	-	-	5	5	-	-	-	-	-	2.5	-	-	15	5	-	40
Bromus spp.	-	-	-	-	-	-	-	52.5	-	-	-	-	-	-	-	-	-	-
Dactylis glomerata	100	-	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Danthonia intermedia	2.5	-	-	-	-	-	-	-	-	25	-	-	-	-	-	-	-	-
Deschampsia caespitosa	-	-	-	-	60	-	-	-	22.5	-	-	-	-	-	-	-	-	-
Elymus cinereus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.5	-	-
Elymus glaucus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
Festuca arundinacea	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Festuca idahoensis	-	10	-	-	-	-	-	37.5	57.9	97.5	-	80	25	87.5	-	-	-	-
Hesperochloa kingii	-	-	2.5	35	-	25	-	-	-	-	-	-	-	-	-	-	20	55
Hordeum brachyantherum	-	-	-	-	27.5	-	-	-	22.5	7.5	-	-	-	-	-	-	-	-
Hordeum jubatum	-	-	-	-	-	-	-	-	-	-	-	-	60	-	-	-	-	-
Koeleria cristata	-	65	-	-	-	-	-	30	-	50	32.5	50	-	82.5	-	62.5	2.5	52.5
Melica spectabilis	-	-	-	-	-	5	-	95	-	10	-	-	-	-	-	-	-	-
Muhlenbergia porteri	-	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Muhlenbergia spp.	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-
Oryzopsis hymenoides	7.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phleum alpinum	-	-	-	-	17.5	10	-	-	7.5	-	-	-	-	-	-	-	-	-
Phleum pratense	-	-	60	-	20	-	-	-	2.5	-	-	-	-	-	-	-	-	-
Poa canbyi	-	-	30	7.5	27.5	17.5	-	-	-	-	-	-	-	10	2.5	-	-	-

Table 8 (cont.)

	Site 58		Site 30		Site 29		Site 79		Site 46		Site 73		Site 76		Site 88		Site 33	
	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site
B. INDIVIDUAL PLANT SPECIES - Cont.																		
1. Perennial Grasses & Grasslikes - Cont.																		
Poa curta	7.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Poa cusickii	-	-	-	-	-	-	-	-	-	-	-	2.5	-	2.5	-	22.5	-	-
Poa fendleriana	-	27.5	-	12.5	-	17.5	-	-	-	-	-	-	-	17.5	-	67.5	2.5	-
Poa grayana	-	-	-	10	-	20	-	-	-	-	-	-	-	-	-	-	-	-
Poa juncifolia	-	-	-	57.5	-	37.5	-	-	-	-	-	-	-	-	-	-	-	-
Poa palustris	-	10	-	-	-	-	-	17.5	17.5	17.5	-	35	-	37.5	-	-	7.5	30
Poa pattersonii	-	-	30	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Poa pratensis	35	35	-	-	25	7.5	5	5	25	-	-	5	15	5	82.5	20	32.5	10
Poa sandbergii	7.5	37.5	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-
Sitanion hystrix	-	-	-	-	-	-	-	-	-	-	-	-	17.5	-	-	-	2.5	-
Stipa columbiana	-	-	-	52.5	-	70	-	-	2.5	12.5	-	-	-	-	-	-	-	-
Stipa comata	-	5	-	-	-	-	-	-	-	7.5	-	82.5	2.5	-	-	-	-	-
Stipa lettermanii	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20	7.5
Stipa spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	17.5	-	-	-	-
Trisetum spicatum	-	-	5	7.5	2.5	22.5	-	-	2.5	-	-	-	-	-	-	-	-	5
Unknown grass	-	-	-	-	-	2.5	-	-	-	32.5	-	-	-	-	-	-	-	-
Carex eleocharis	-	57.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carex filifolia	-	-	-	-	-	-	-	-	12.5	5	-	-	-	-	-	-	-	-
Carex hellophila	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	15	-	-
Carex hoodii	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	27.5
Carex microptera	-	-	-	-	32.5	17.5	-	-	20	-	-	-	-	-	5	-	-	-
Carex phaeocephala	-	-	-	70	-	7.5	-	-	-	27.5	-	-	-	-	-	-	-	-
Carex rossii	-	-	-	-	-	-	-	27.5	-	-	-	-	-	-	-	-	-	-
Carex spp.	-	-	-	-	2.5	2.5	-	-	-	-	7.5	30	-	55	-	-	-	-
Juncus balticus	-	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Juncus longistylus	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Juncus nevadensis	-	-	-	-	-	-	-	-	17.5	52.5	-	-	-	-	-	-	-	-
Scirpus spp.	-	-	-	-	-	-	-	-	22.5	-	-	-	-	-	-	-	-	-
2. Perennial Forbs																		
Achillea millefolium	-	12.5	52.5	67.5	30	85	62.5	65	75	50	2.5	-	12.5	75	12.5	-	15	70
Agoseris spp.	2.5	7.5	-	-	2.5	2.5	-	-	2.5	-	-	5	-	-	2.5	-	5	10
Allium acuminatum	-	-	-	-	-	-	-	-	-	-	7.5	67.5	-	-	-	-	-	-
Allium spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
Antennaria anaphaloides	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-

TABLE 8 (cont.):

	Site 58		Site 30		Site 29		Site 79		Site 46		Site 73		Site 76		Site 88		Site 33	
	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site
B. INDIVIDUAL PLANT SPECIES - Cont.																		
2. Perennial Forbs - Cont.																		
Antennaria dimorpha	7.5	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	12.5	-	-
Antennaria microphylla	-	80	-	37.5	-	2.5	-	7.5	12.5	40	-	12.5	-	40	-	22.5	2.5	12.5
Aquilegia flavescens	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.5
Arabis spp.	2.5	42.5	-	57.5	-	10	2.5	10	-	5	2.5	7.5	-	-	-	-	2.5	27.5
Arenaria congesta	-	7.5	-	40	-	-	-	15	-	77.5	-	7.5	-	10	-	-	2.5	32.5
Aster chilensis	2.5	45	-	-	15	-	32.5	90	-	-	20	-	100	30	25	55	-	-
Aster spp.	5.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Balsamorhiza sagittata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	7.5	-
Bessia wyomingensis	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-
Borage spp.	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Castelleja sulphurea	-	-	-	-	-	20	-	-	-	-	-	-	-	-	-	-	-	-
Castelleja spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	-
Cerastrium spp.	-	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chamaetis spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	27.5	-
Circium spp.	-	10	-	-	-	-	7.5	-	37.5	10	-	-	17.5	-	12.5	-	17.5	-
Claytonia lanceolata	-	-	-	-	-	-	-	-	-	-	-	7.5	-	7.5	-	-	-	-
Clematis hirsutissima	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5
Comandra umbellata	-	72.5	-	-	-	-	-	-	-	-	-	5	-	-	-	17.5	-	-
Crepis atrabarba	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12.5
Crepis spp.	-	-	-	-	-	5	5	15	-	-	-	-	-	-	-	-	-	-
Delphinium bicolor	-	-	-	-	-	-	-	27.5	-	-	-	-	-	-	-	-	-	-
Delphinium nuttalli	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12.5
Delphinium occidentale	-	-	-	-	-	12.5	-	-	-	-	-	-	-	-	-	-	-	-
Epilobium angustifolium	-	-	-	-	-	-	-	-	-	10	-	-	-	-	-	-	-	-
Erigeron caespitosus	-	42.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Erigeron compositus	-	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Erigeron pumilus	-	7.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Erigeron speciosus	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Erigeron spp.	-	-	-	-	-	5	-	-	12.5	37.5	2.5	-	-	-	-	-	30	5
Eriogonum umbellatum	-	35	-	92.5	-	45	-	90	-	35	5	85	-	22.5	-	72.5	17.5	25
Fragaria virginiana	-	27.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Frasera speciosa	-	-	-	-	-	15	-	-	-	37.5	-	-	-	-	-	-	-	-
Geranium richardsonii	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	27.5
Geranium viscosissimum	2.5	-	-	-	-	30	-	-	-	62.5	-	-	-	-	7.5	5	-	-
Geum triflorum	-	-	-	52.5	-	-	-	-	2.5	45	-	-	-	-	-	-	-	2.5
Gilia aggregata	-	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Haplopappus acaulis	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE 8 (cont.)

	Site 58		Site 30		Site 29		Site 79		Site 46		Site 73		Site 76		Site 88		Site 33	
	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site
B. INDIVIDUAL PLANT SPECIES - Cont.																		
2. Perennial Forbs - Cont.																		
Helenium hoopesii	-	-	-	-	-	47.5	-	-	55	2.5	-	-	-	-	-	-	-	-
Helianthela uniflora	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	35
Ligusticum filicinum	-	-	-	-	-	30	-	-	-	-	-	-	-	-	-	-	-	-
Linum lewisii	-	-	-	-	-	-	-	5	-	2.5	-	-	-	-	-	-	-	-
Lithophragma bulbifera	-	-	-	-	-	-	-	-	-	-	-	37.5	-	22.5	-	-	-	-
Lithophragma parviflora	-	-	-	-	-	-	2.5	10	5	-	-	-	-	-	-	-	-	-
Lomatium foeniculaceum	10	57.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lomatium simplex	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	22.5
Macaranthera canescens	-	7.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mertensia longiflora	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-
Mertensia oblongifolia	-	-	-	-	-	-	-	-	-	-	-	-	-	17.5	-	-	-	-
Mertensia spp.	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-
Microseris spp.	-	10	-	-	-	-	-	-	-	-	12.5	-	-	-	-	-	-	-
Myosotis spp.	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-
Oenothera spp.	-	-	-	-	-	-	-	-	-	-	-	-	15	-	-	-	-	-
Orogenia linearifolia	-	-	-	-	-	-	-	10	-	-	-	-	-	7.5	-	-	-	-
Orthocarpos luteus	-	55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Osmorhiza chilensis	-	-	-	-	-	2.5	2.5	-	-	-	-	-	-	-	-	-	-	-
Pedicularis spp.	-	-	-	-	-	-	-	-	-	15	-	-	-	-	-	-	-	-
Penstemon humilus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	5
Penstemon spp.	-	-	-	-	-	15	-	-	2.5	-	-	-	-	-	5	-	-	-
Perideridia gairdneri	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-
Phacelia sericeus	-	-	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phlox hoodii	-	-	-	37.5	-	47.5	-	-	-	-	-	5	-	25	-	22.5	-	-
Phlox longifolia	-	-	-	-	-	-	-	-	-	55	-	-	-	-	-	-	-	47.5
Plantago tweedyi	-	-	-	-	27.5	2.5	-	-	-	-	-	-	-	-	-	-	-	-
Potentilla gracilis	2.5	-	10	22.5	-	30	-	5	52.5	30	-	-	-	-	-	-	-	22.5
Potentilla spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-
Rumex salicifolius	-	5	2.5	-	7.5	20	-	37.5	5	30	-	2.5	-	-	-	-	-	-
Rumex spp.	-	-	-	-	-	-	-	-	-	-	7.5	-	-	10	-	-	-	5
Sedum stenopetalum	7.5	72.5	-	-	-	-	-	-	-	-	2.5	17.5	-	-	-	-	-	10
Senecio dimorphophyllus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	37.5	-
Senecio integerrimus	-	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15
Senecio spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15
Sisyrinchium angustifolium	-	17.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Solidago canadensis	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	42.5	50
Solidago spp.	-	-	-	-	-	45	-	-	-	-	-	-	-	-	-	-	-	7.5
Stellaria jamesiana	-	-	17.5	37.5	-	75	-	-	-	-	-	-	-	-	-	-	-	75
Taraxacum officinale	12.5	35	-	-	20	12.5	45	57.5	100	22.5	97.5	2.5	47.5	12.5	7.5	-	7.5	5

TABLE 8 (cont.):

	Site 58		Site 30		Site 29		Site 79		Site 46		Site 73		Site 76		Site 88		Site 33	
	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site
B. INDIVIDUAL PLANT SPECIES - Cont.																		
2. Perennial Forbs - Cont.																		
Thalictrum occidentale	-	-	-	-	-	-	-	-	-	10	-	-	-	-	-	-	-	-
Tragopogon dubius	-	-	-	-	-	-	12.5	-	-	-	-	-	-	-	-	-	-	-
Trollius laxus	-	12.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Valeriana spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25
Viola adunca	-	-	-	-	-	-	-	-	-	50	-	-	-	-	-	-	-	5
Viola nuttallii	-	-	-	-	-	-	-	70	-	-	2.5	2.5	-	-	-	-	-	62.5
Viola purpurea	-	-	-	-	-	-	-	-	-	-	10	2.5	-	-	-	-	2.5	-
Viola spp.	-	50	-	2.5	-	25	-	5	-	-	-	-	-	22.5	-	55	7.5	-
Perennial #1	-	-	-	-	-	-	20	2.5	-	-	32.5	5	-	7.5	-	-	-	-
Perennial #3	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-
Perennial #4	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-
Perennial #6	-	-	-	-	-	-	-	10	-	-	-	-	-	-	-	-	-	-
Perennial #8	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-
Perennial #9	-	-	-	-	-	-	-	25	-	-	-	-	-	-	-	-	-	-
Perennial #10	-	-	-	-	-	-	-	20	-	-	-	-	-	-	7.5	-	-	-
Perennial #12	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-
Perennial #14	-	27.5	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-	2.5
Perennial #15	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Perennial #16	-	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Perennial #18	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Perennial #23	-	-	-	-	-	35	-	-	-	-	-	-	-	-	-	45	-	-
Perennial #24	-	-	-	-	-	-	-	-	12.5	-	-	-	-	-	-	-	-	-
Perennial #30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.5	-	-
Perennial #31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-
Perennial #32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15	2.5
Perennial #33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	27.5
Perennial #36	-	-	-	-	-	-	-	-	-	10	-	-	-	-	-	-	-	-
Perennial #40	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-
Perennial #41	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-
Perennial #42	-	-	-	-	-	45	-	-	-	-	-	-	-	-	-	-	-	-
Perennial #43	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-

TABLE 8 (cont.):

	Site 58		Site 30		Site 29		Site 79		Site 46		Site 73		Site 76		Site 88		Site 33	
	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site
B. INDIVIDUAL PLANT SPECIES - Cont.																		
3. Annual Forbs																		
Androsace septentrionalis	-	12.5	2.5	-	-	2.5	-	17.5	-	2.5	-	-	2.5	22.5	-	-	-	-
Borage spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-
Capsella bursa-pastoris	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chenopodium album	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5
Collinsia parviflora	-	17.5	-	-	-	-	-	-	2.5	-	-	-	-	10	-	-	-	12.5
Collomia linearis	25	-	-	-	-	-	-	-	2.5	-	2.5	-	-	-	-	-	7.5	47.5
Cordylanthus ramosus	-	12.5	-	-	-	-	-	-	-	-	-	-	-	-	-	25	-	-
Cruciferae spp.	-	-	-	-	-	-	-	-	7.5	-	-	-	-	-	-	-	27.5	2.5
Descurainia spp.	-	-	-	-	-	7.5	-	-	-	-	-	-	-	-	-	-	-	-
Draba spp.	-	27.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Epilobium paniculatum	-	25	-	-	57.5	-	-	-	5	15	17.5	-	-	35	-	-	-	-
Gallium bifforum	-	-	-	-	-	7.5	-	-	2.5	-	-	-	-	-	-	-	10	25
Gayophytum diffusum	-	-	-	-	10	-	10	37.5	-	-	80	77.5	92.5	62.5	-	2.5	-	-
Lepidium campestre	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lepidium spp.	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-
Linanthus harknessii	7.5	25	-	-	-	-	-	-	5	5	67.5	90	-	27.5	-	-	-	-
Nemophila breviflora	-	-	-	-	-	-	-	25	-	-	-	-	-	-	-	-	2.5	50
Orthocarpus tolmiei	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-
Polygonum confertiflorum	-	-	-	-	-	-	-	-	17.5	-	-	-	-	-	-	-	-	-
Polygonum douglasii	12.5	47.5	65	-	52.5	5	-	-	32.5	-	-	-	-	-	-	-	2.5	10
Polygonum spp.	25	-	-	-	55	-	-	-	-	-	-	-	-	-	-	-	-	-
Veronica biloba	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.5	7.5
Annual #4	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-
Annual #5	-	-	-	-	-	-	-	-	-	-	-	-	-	50	-	-	-	-
Annual #6	2.5	-	-	-	-	-	-	-	-	-	-	-	-	7.5	-	-	-	-
Annual #7	17.5	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-
Annual #9	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-
Annual #10	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Annual #13	-	-	-	-	-	-	-	-	7.5	-	-	-	-	-	-	-	-	-
Annual #15	-	-	-	-	-	-	-	-	-	-	-	-	-	30	-	-	-	-
Annual #35	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-

TABLE 8 (cont.):

	Site 58		Site 30		Site 29		Site 79		Site 46		Site 73		Site 76		Site 88		Site 33	
	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site
B. INDIVIDUAL PLANT SPECIES - Cont.																		
4. Leguminous Forbs																		
Astragalus misor	2.5	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Astragalus spicatus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.5	15
Astragalus spp. #1	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Astragalus spp. #2	-	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Astragalus spp. #3	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lupinus argenteus	-	-	-	-	-	7.5	-	-	17.5	47.5	-	-	-	-	-	22.5	-	-
Lupinus caudatus	-	-	-	-	-	-	-	-	-	-	-	-	-	32.5	-	-	-	-
Lupinus lepidus	-	-	2.5	10	-	-	-	-	7.5	-	-	-	-	-	-	-	-	-
Lupinus leucophyllus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	32.5
Lupinus sericeus	-	-	-	-	-	-	5	32.5	-	-	60	75	-	-	42.5	-	-	-
Lupinus wyethia	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oxytropis spp.	-	10	-	-	-	-	-	-	-	-	-	-	-	-	2.5	22.5	-	-
Trifolium gymnocarpon	-	-	-	35	-	-	-	-	-	-	-	-	7.5	25	-	-	-	45
Trifolium longipes	-	-	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trifolium pratense	27.5	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-
Trifolium repens	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trifolium spp.	-	-	-	-	-	12.5	-	-	27.5	12.5	-	-	-	-	-	-	2.5	-
B. INDIVIDUAL PLANT SPECIES - Cont.																		
5. Shrubs																		
Amelanchier alnifolia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	2.5	-
Artemisia arbuscula	-	-	-	-	-	-	-	-	-	-	-	-	-	55	-	-	-	-
Artemisia cana	-	-	-	-	-	-	-	-	55	52.5	-	-	2.5	32.5	-	-	-	-
Artemisia tridentata var. vaseyana	10	47.5	2.5	90	-	82.5	5	95	22.5	62.5	95	100	10	32.5	50	97.5	45	80
Chrysothamnus nauseosus	-	-	-	-	-	-	-	-	-	-	12.5	-	-	-	-	2.5	-	-
Chrysothamnus viscidiflorus	-	2.5	-	-	-	-	-	-	-	-	-	2.5	-	10	-	15	22.5	30
Potentilla fruticosa	-	7.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ribes spp.	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-
Rosa woodsii	-	72.5	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-
Salix spp.	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-
Symphoricarpos spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.5	22.5	10	15
Tetradymia canescens	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-

TABLE 8 (cont.):

	Site 58		Site 30		Site 29		Site 79		Site 46		Site 73		Site 76		Site 88		Site 33	
	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site
C. GROUND COVER																		
Bareground	100	87.5	100	82.5	100	80	100	60	100	75	100	100	100	100	75	90	100	100
Litter	100	100	100	95	100	100	100	100	100	100	100	100	100	100	97.5	100	87.5	100
Moss/Lichen	0	82.5	0	0	60	0	12.5	15	50	2.5	32.5	25	0	62.5	0	7.5	0	5
Basal Stems	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	97.5	100
Small Rocks (<2 cm)	97.5	20	97.5	75	95	60	97.5	42.5	82.5	70	100	100	95	10	37.5	67.5	92.5	45
Medium Rocks (2-30 cm)	97.5	20	100	65	100	47.5	100	55	67.5	30	100	100	32.5	12.5	30	40	90	35
Large Rocks (>30 cm)	0	0	0	0	0	0	0	0	0	2.5	0	0	0	0	0	0	5	2.5

1/ Independently estimated; i.e., not summed parameters.

TABLE 9: Estimated mean shrub density (stems/ha) by height class for all sagebrush sites, 1982.

Species	Height Class[1/]	Site 58		Site 30		Site 29		Site 79		Site 46		Site 73		Site 76		Site 88		Site 33	
		Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.
Arctostaphylos uva-ursi	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2	-	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	TOTAL	-	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Artemisia arbuscula	1	-	-	-	-	-	-	-	-	-	-	-	-	-	15200	-	-	-	-
	2	-	-	-	-	-	-	-	-	-	-	-	-	-	32400	-	50	-	-
	3	-	-	-	-	-	-	-	-	-	-	-	-	-	10900	-	-	-	-
	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	TOTAL	-	-	-	-	-	-	-	-	-	-	-	-	-	58500	-	50	-	-
Artemisia cana	1	-	-	-	-	-	-	-	-	650[a2/]	6150[a]	-	-	100[b]	8650[a]	-	-	-	-
	2	-	-	-	-	-	-	-	-	8350[a]	3650[a]	-	-	450[b]	3450[a]	-	50	-	-
	3	-	-	-	-	-	-	-	-	10300[a]	7850[a]	-	-	200[b]	4500[a]	-	-	-	-
	4	-	-	-	-	-	-	-	-	200[b]	1150[a]	-	-	-	50	-	-	-	-
	TOTAL	-	-	-	-	-	-	-	-	19500[a]	18800[a]	-	-	750[b]	16650[a]	-	50	-	-
Artemisia tridentata var. vaseyana	1	400[a]	1650[a]	100[b]	800[a]	-	350	2400[b]	6600[a]	350[a]	4850[a]	48000[a]	3550[b]	350[b]	2750[a]	30700[a]	1150[b]	800	-
	2	2950[a]	4500[a]	300[b]	9500[a]	-	750	550[b]	2900[a]	1650[a]	4150[a]	42650[a]	15300[b]	600[b]	9200[a]	13200[a]	4350[b]	2200[a]	600[b]
	3	450[b]	10600[a]	50[b]	23900[a]	-	12800	300[b]	10300[a]	6850[a]	4800[a]	21450[a]	23600[a]	450[b]	6950[a]	8350[b]	21350[a]	4300[a]	6050[a]
	4	-	200	-	1850	-	3650	-	4950	250[b]	3550[a]	50[b]	400[a]	-	1000	400[b]	7450[a]	600[b]	5700[a]
	TOTAL	3800[b]	16950[a]	450[b]	36050[a]	-	17550	3250[b]	24750[a]	9100[a]	17350[a]	112150[a]	42850[b]	1400[b]	19900[a]	52650[a]	34300[a]	7900[b]	12350[a]
Berberis repens	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50[a]	100[a]	-	-
	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	TOTAL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50[a]	100[a]	-	-
Chrysothamnus nauseosus	1	-	-	-	-	-	-	-	-	-	-	300	-	-	-	100	-	-	-
	2	-	-	-	-	-	-	-	-	-	-	3000	-	-	-	50	-	-	-
	3	-	50	-	-	-	-	-	-	-	-	5550[a]	50[b]	-	-	50[b]	1450[a]	150	-
	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50[b]	350[a]	-	-
	TOTAL	-	50	-	-	-	-	-	-	-	-	8850[a]	50[b]	-	-	250[b]	1800[a]	150	-

TAB E 9 (cont.)

Species	Height Class[1]	Site 58		Site 30		Site 29		Site 79		Site 46		Site 73		Site 76		Site 88		Site 33	
		Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.
Chrysothamnus viscidiflorus	1	-	-	-	-	-	-	-	-	-	-	-	-	-	150	-	150	150	-
	2	-	-	-	-	-	-	-	-	-	-	-	-	-	1400	-	1100	1800[a]	450[b]
	3	-	-	-	-	-	-	-	-	-	-	-	-	-	1300	-	750	1900[b]	5950[a]
	4	-	-	-	-	-	-	-	-	-	-	-	-	-	50	-	-	-	300
	TOTAL	-	-	-	-	-	-	-	-	-	-	-	-	-	2900	-	2000	3850[a]	6700[a]
Leptodactylon punguns	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2	300	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	TOTAL	300	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potentilla fruticosa	1	-	200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2	-	900	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3	-	1950	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	4	-	100	-	-	-	-	-	-	-	100	-	-	-	-	-	-	-	-
	TOTAL	-	3150	-	-	-	-	-	-	-	100	-	-	-	-	-	-	-	-
Prunus virginiana	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	-	-	-
	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	TOTAL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	-	-	-
Purshia tridentata	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	-	-
	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50	-	-
	TOTAL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	150	-	-
Ribes cereum	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	200
	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100
	TOTAL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	300

TABLE 9 (cont.)

Species	Height Class 1/	Site 58		Site 30		Site 29		Site 79		Site 46		Site 73		Site 76		Site 88		Site 33	
		Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.
Ribes montigenum	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3	-	-	-	-	-	250	-	-	-	-	-	-	-	-	-	-	-	-
	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	TOTAL	-	-	-	-	-	250	-	-	-	-	-	-	-	-	-	-	-	-
Rosa woodsii	1	-	1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2	-	24750	-	-	-	-	-	-	-	-	-	-	-	-	250[a]	100[a]	-	-
	3	50[b]	24350[a]	-	-	-	-	-	-	-	-	-	-	-	-	250[a]	100[a]	-	-
	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	TOTAL	50[b]	50100[a]	-	-	-	-	-	-	-	-	-	-	-	-	500[a]	200[a]	-	-
Salix spp.	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3	-	-	-	-	-	-	-	-	50	-	-	-	-	-	-	-	-	-
	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	TOTAL	-	-	-	-	-	-	-	-	50	-	-	-	-	-	-	-	-	-
Shepherdia canadensis	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	4	-	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	TOTAL	-	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Symphoricarpos spp.	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50	-	50	-
	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100[b]	600[a]	-	50
	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	400[b]	5100[a]	250[a]	1150[a]
	4	-	200	-	-	-	-	-	-	-	-	-	-	-	-	-	250	50[b]	900[a]
	TOTAL	-	200	-	-	-	-	-	-	-	-	-	-	-	-	500[b]	5950[a]	300[b]	2100[a]
Tetradymia canescens	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	-	-
	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	700	-	-
	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	TOTAL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	800	-	-

1/ 1 = 5 cm; 2 = 5-15 cm; 3 = 16-60 cm; 4 = 61-140 cm

2/ Values between disturbed-native site pairs followed by the same letter are not significantly different at the .05 level (T-test).

TABLE 10: Plant community descriptors[1] for all sagebrush sites

Site	Spatz Similarity Index (%)	Shannon-Weiner Diversity Index		Richness (Total Number of Species)		Number of Species Common To Both Sites
		Dist.	Nat.	Dist.	Nat.	
58	1.72	.84	1.44	33	62	13
30	3.5	.95	.94	21	26	11
29	1.6	.96	1.2	24	54	14
79	4.2	.39	1.81	17	36	11
46	9.06	1.18	1.30	48	43	22
73	10.65	.82	.85	28	30	14
76	4.17	.74	1.18	17	45	10
88	3.85	.77	.93	20	33	9
33	9.9	1.30	1.40	44	57	27

TABLE 11: Total number of droppings counted per site on all sagebrush sites, 1982.

Species	Site 58		Site 30		Site 29		Site 79		Site 46		Site 73		Site 76		Site 88		Site 33	
	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.
Cattle	32^{a} 1/	38^{a}	11	0	2	0	51^{a}	32^{b}	40^{b}	64^{a}	12^{a}	20^{a}	3^{b}	21^{a}	-	-	29	0
Sheep	-	-	33^{a}	13^{b}	92^{a}	108^{a}	-	-	-	-	-	-	18^{a}	26^{a}	-	-	-	-
Horses	-	-	6	0	4^{a}	2^{a}	-	-	-	-	-	-	-	-	-	-	-	-
Deer	6^{b}	30^{a}	1	0	2	0	-	-	-	-	0	2	-	-	0	23	-	-
Elk	1^{b}	20^{a}	1	0	-	-	-	-	3	0	-	-	-	-	-	-	-	-
Antelope	0	5	-	-	-	-	-	-	-	-	1^{a}	3^{a}	4^{a}	4^{a}	3	0	-	-
Moose	0	2	-	-	-	-	-	-	-	-	-	-	-	-	1^{a}	1^{a}	-	-

1/ Values between disturbed-native site pairs followed by the same letter are not significantly different at the .05 level (T-test).

TABLE 12. Results of laboratory analysis of soil samples from all sagebrush sites, 1982.

Parameter	Depth[1]	Site 58		Site 30		Site 29		Site 79		Site 46		Site 73		Site 76		Site 88		Site 33	
		Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.
Textural Class[2]	1	C	L	SCL	SL	SCL	SL	SCL	SCL	SL	SL	SL	SL	C	cl	cl	SIL	L	cl
	2	SL	SCL	SCL	SL	SCL	SCL	SCL	SCL	SL	SL	-[3]	L	C	cl	cl	L	L	cl
	3	SL	L	SCL	SCL	SCL	SCL	SCL	SCL	SL	SL	SCL	SL	L	cl	cl	L	-	cl
	4	LS	L	SCL	SCL	SCL	SCL	SCL	SCL	SL	SL	SCL	SL	C	cl	cl	L	-	SIL
	5	LS	L	SCL	SCL	SCL	SCL	SCL	SCL	SL	SL	SL	SL	C	cl	cl	cl	-	-
Sand (%)	1	25	48	53	57	56	55	53	54	64	63	58	64	26	40	39	21	25	21
	2	69	57	53	57	55	54	53	53	66	66	-	64	25	39	38	37	30	20
	3	73	50	53	57	53	52	53	53	66	66	58	64	39	35	35	36	-	20
	4	86	44	57	56	51	52	53	53	66	68	56	67	25	26	33	37	-	24
	5	86	50	57	56	51	53	55	52	66	67	61	72	22	35	32	28	-	-
Silt (%)	1	22	28	23	27	23	26	26	23	18	20	22	21	28	23	31	56	50	48
	2	16	22	24	22	22	24	26	24	16	16	-	20	27	21	30	38	50	50
	3	14	29	27	22	26	24	25	24	15	16	21	20	36	25	34	37	-	51
	4	5	37	21	22	27	25	25	24	17	16	22	19	26	34	37	36	-	55
	5	5	30	22	22	27	23	24	25	17	16	20	16	23	29	40	37	-	-
Clay (%)	1	53	24	24	16	21	19	21	23	18	17	20	15	46	37	30	23	25	31
	2	15	21	23	21	23	22	21	23	18	18	-	16	48	40	32	25	20	30
	3	13	21	20	21	21	24	22	23	19	18	21	16	25	40	31	27	-	29
	4	9	19	22	22	22	23	22	23	17	16	22	14	49	40	30	27	-	21
	5	9	20	21	22	22	24	21	23	17	17	19	12	55	36	28	35	-	-
Total Coarse Fragments (%)	1	25	1	30	10	25	3	40	8	12	5	10	3	1	1	1	5	15	5
	2	25	1	30	15	25	3	40	10	12	5	30	15	1	1	3	5	50	10
	3	30	1	30	20	25	3	50	10	25	5	40	35	1	1	3	7	80	70
	4	40	1	70	20	25	3	50	75	25	5	40	40	1	1	3	30	-	70
	5	40	60	70	30	30	3	50	75	25	5	50	65	5	3	1	5	-	70
Coarse Fragments <1.2 cm (%)	1	20	100	70	99	83	100	90	100	80	100	80	100	100	100	100	100	50	100
	2	20	100	70	95	83	100	90	100	80	100	100	90	100	100	100	100	50	20
	3	30	100	70	95	83	100	80	100	65	100	90	90	100	100	100	100	20	10
	4	40	100	20	90	83	100	80	90	65	100	90	60	100	100	100	25	-	10
	5	40	50	20	30	65	100	80	90	65	100	60	80	80	100	100	80	-	10
Coarse Fragments >1.2 cm (%)	1	80	0	30	1	17	0	10	0	20	0	20	0	0	0	0	0	50	0
	2	80	0	30	5	17	0	10	0	20	0	0	10	0	0	0	0	50	80
	3	70	0	30	5	17	0	20	0	35	0	10	10	0	0	0	0	80	90
	4	60	0	80	10	17	0	20	10	35	0	10	40	0	0	0	75	-	90
	5	60	50	80	70	35	0	20	10	35	0	40	20	20	0	0	20	-	90

TABLE 12 (cont.):

Parameter	Depth[1/]	Site 58		Site 30		Site 29		Site 79		Site 46		Site 73		Site 76		Site 88		Site 33	
		Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.
Bulk Density (g/cm^3)	1	1.78	1.43	1.38	1.03	1.14	1.04	1.79	1.07	1.71	1.02	1.62	1.51	1.66	1.22	1.29	1.39	1.46	1.20
	2	1.77	1.30	1.34	1.07	1.18	1.33	1.79	1.14	1.79	1.42	1.74	1.13	1.42	1.39	1.25	1.42	-	1.29
	3	-	1.33	1.20	1.38	1.99	1.33	1.77	1.02	1.79	1.51	1.51	1.53	1.70	1.36	1.57	1.43	-	1.23
	4	-	1.69	1.77	1.35	1.81	1.44	1.83	1.43	1.93	1.61	1.67	1.55	1.66	1.69	1.52	1.57	-	-
	5	-	1.63	1.80	1.35	1.82	1.35	1.77	1.51	1.90	1.68	1.77	1.58	1.79	1.63	1.71	1.46	-	-
pH	1	7.7	7.5	6.1	6.2	6.6	5.9	6.5	6.1	7.4	6.2	6.4	5.9	7.4	6.4	7.0	7.9	7.2	6.5
	2	7.8	7.7	6.1	6.1	6.7	6.0	6.5	6.5	7.4	6.0	7.2	6.3	7.5	6.3	7.3	7.8	7.3	6.5
	3	7.8	7.9	6.9	5.9	7.3	6.2	6.7	6.6	7.4	6.1	7.0	6.2	7.7	6.5	7.5	7.9	-	6.7
	4	8.0	7.8	7.1	5.8	7.4	6.1	6.8	6.4	7.6	6.1	6.7	6.2	7.6	6.9	7.8	7.9	-	7.1
	5	8.2	7.8	7.2	5.6	7.5	6.0	6.7	6.6	7.6	6.1	6.6	6.2	7.6	7.4	7.8	8.0	-	-
Available Phosphorus (ppm)	1	6	10	34	27	19	30	27	51	20	34	30	47	27	38	49	37	31	16
	2	7	8	25	26	13	35	32	51	16	20	40	49	23	29	46	31	18	16
	3	6	4	27	28	12	40	30	59	16	18	37	55	15	26	41	27	-	15
	4	4	3	22	27	11	38	41	46	10	16	35	46	58	26	29	20	-	14
	5	4	4	22	30	12	18	32	36	10	16	22	37	23	6	29	9	-	-
Potassium (meq/100g)	1	.68	1.01	1.08	1.11	.50	.82	.72	1.07	.58	1.29	.86	.75	.74	1.36	1.39	.99	1.19	1.21
	2	.34	.70	.83	.85	.36	.72	.72	.97	.35	.93	.73	.81	.59	1.39	1.49	1.03	.95	1.23
	3	.33	.43	.55	.64	.26	.61	.52	1.05	.20	.91	.67	.77	.30	1.32	1.18	.94	-	.96
	4	.21	.31	.32	.64	.25	.53	.57	.77	.17	.96	.67	.45	.42	1.23	.88	.84	-	.81
	5	.21	.33	.29	.62	.27	.44	.60	.65	.21	.54	.59	.38	.49	.96	.76	.63	-	-
Organic Matter (%)	1	1.2	6.4	6.2	11.1	3.6	13.2	2.2	11.9	4.4	12.6	4.4	8.7	2.1	6.4	13.0	5.7	5.6	6.4
	2	1.8	4.6	6.0	5.4	6.0	4.4	2.2	8.8	4.6	7.3	4.2	5.4	1.8	4.4	9.0	5.0	5.9	6.6
	3	1.2	2.4	4.1	3.1	3.6	2.4	2.0	8.4	4.8	5.1	4.7	3.0	.8	3.2	7.2	3.7	-	5.1
	4	.6	1.5	1.9	2.9	3.1	2.1	2.2	4.7	3.6	4.4	3.6	1.2	3.8	3.6	3.4	3.4	-	5.1
	5	.2	1.4	1.8	3.3	3.2	1.6	1.9	4.0	3.6	3.9	1.8	1.1	1.4	2.0	2.6	2.4	-	-
Cation Exchange Capacity (meq/100g)	1	44.7	30.8	19.6	21.6	20.1	24.7	14.1	31.0	15.6	49.7	17.6	18.4	32.9	42.7	39.2	22.4	25.4	25.5
	2	18.0	26.8	17.7	16.8	19.3	13.9	14.5	27.2	17.6	38.8	17.9	17.5	32.1	43.6	32.2	23.0	24.1	27.2
	3	13.7	23.2	15.1	13.3	13.6	10.7	14.1	26.3	18.1	33.9	18.4	12.2	21.0	43.9	29.1	20.5	-	27.4
	4	8.1	23.1	11.3	13.4	12.1	9.8	15.1	21.0	28.5	32.4	17.1	8.4	53.0	43.8	20.8	18.2	-	29.6
	5	7.5	21.4	11.1	13.4	11.8	9.5	14.2	18.6	30.0	30.8	13.2	7.6	34.4	44.4	19.3	16.8	-	-
Sodium (meq/100g)	1	.1	.1	<.1	<.1	.1	<.1	<.1	.1	.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
	2	.1	.1	<.1	<.1	<.1	<.1	<.1	<.1	.1	<.1	<.1	<.1	.1	<.1	<.1	<.1	<.1	<.1
	3	.2	.1	.1	<.1	.1	<.1	<.1	<.1	.2	<.1	<.1	<.1	.1	<.1	<.1	<.1	-	<.1
	4	.1	.1	<.1	<.1	<.1	<.1	.1	<.1	.2	<.1	<.1	<.1	.1	<.1	<.1	<.1	-	<.1
	5	.1	.1	.1	<.1	.3	<.1	.1	<.1	.2	<.1	<.1	<.1	.2	<.1	<.1	<.1	-	-

TABLE 12 (cont.):

Parameter	Depth[1/]	Site 58		Site 30		Site 29		Site 79		Site 46		Site 73		Site 76		Site 88		Site 33	
		Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.
Calcium (meq/100g)	1	43.7	24.0	8.5	10.5	13.4	14.7	8.1	17.1	13.5	18.7	8.4	9.1	45.0	28.2	25.9	28.5	30.4	16.9
	2	16.4	18.3	8.5	6.2	13.3	5.5	8.5	15.7	13.6	9.4	11.8	7.6	45.2	32.0	25.2	31.9	35.7	16.7
	3	15.3	17.0	17.3	3.9	20.5	3.4	8.9	16.2	15.1	7.8	11.2	4.9	39.5	32.3	33.1	34.4	-	18.7
	4	10.9	25.8	26.0	3.4	21.6	2.9	7.9	11.3	15.3	7.3	8.2	3.4	51.7	34.0	33.1	35.9	-	25.1
	5	8.6	22.5	33.7	3.6	21.3	2.4	7.6	9.7	16.0	6.8	5.6	3.1	44.0	38.4	32.4	26.0	-	-
Magnesium (meq/100g)	1	3.0	1.5	.6	.8	.4	1.0	.5	.9	.9	1.3	.8	.7	1.6	2.4	1.8	.9	.5	.7
	2	1.1	1.5	.6	.5	.4	.5	.5	.8	.9	.6	.7	.7	1.8	2.5	1.7	1.2	.4	.7
	3	.9	1.4	.4	.4	.4	.3	.4	.7	.8	.7	.6	.6	2.1	2.3	1.4	1.3	-	.6
	4	.6	1.3	.4	.3	.3	.3	.6	.6	.8	.5	.7	.5	4.6	2.1	1.2	1.2	-	.4
	5	.5	1.2	.3	.4	.4	.2	.6	.6	.8	.6	.6	.5	4.1	2.6	1.4	1.3	-	-
Sodium Absorption Ratio	1	1.1	.5	.8	.3	.5	.3	.7	.3	1.2	.4	.4	.5	.6	.5	.4	.4	.3	.3
	2	1.3	.8	.5	.3	.6	.4	1.0	.6	.8	.4	.3	.7	.7	.5	.3	.4	.2	.4
	3	1.4	1.0	.3	.6	.8	.5	.9	.6	1.0	.3	.3	.6	.6	.4	.4	.3	-	.4
	4	2.2	1.0	.6	.4	1.7	.7	.6	.9	1.2	.7	.8	.7	.9	.2	.3	.4	-	1.3
	5	2.2	1.1	.7	.4	2.3	.9	.5	.7	1.5	.5	1.1	1.0	.8	.7	.5	.4	-	-
Electrical Conductivity (millimhos)	1	.3	1.2	.6	.5	.5	.9	.4	.4	.8	.5	.2	.3	.5	.1	.6	.7	.4	.4
	2	.4	.8	.6	.5	.6	.3	.7	.4	.6	.4	.3	.4	.5	.3	.7	.7	.4	.4
	3	.5	.6	.6	.6	.6	.4	.6	.4	.5	.4	.3	.4	.4	.1	.6	.9	-	.2
	4	.3	.5	.5	.3	.7	.4	.3	.4	.5	.3	.2	.3	.5	.4	.5	.6	-	.8
	5	.2	.7	.5	.3	.6	.4	.3	.7	.6	.3	.4	.4	.7	.4	.4	.5	-	-

1/ 1 = 0-5 cm; 2 = 6-10 cm; 3 = 11-20 cm; 4 = 21-30 cm; 5 = 31-50 cm

2/ C = Clay; CL = Clay Loam; L = Loam; LS = Loamy Sand; SL = Sandy Loam; SCL = Sandy Clay Loam; SIL = Silt Loam

3/ Samples were not available where values are missing.

APPENDIX D

II. Coniferous Sites

TABLE 13. Physical parameters and location of each coniferous site intensively sampled.

Site Number	Age Since Abandonment[1] (Years)	Seeded	Size (ha)	Elevation (meters)	Slope (%)	Aspect	Road Closed	Native Habitat Classification[2]	Native Soil Classification[3]	District	Legal Location	U.S.G.S. Topographic Map
9	3	Yes	1.6	2970	3-8	Northeast	No	Abies lasiocarpa/ Arnica cordifolia	Typic and Lithic Cryoboroll	Big Piney	28N 115W Sec. 26 SENE	Pinegrove Ridge
36	4	Yes	1.1	2380	3-12	Southwest	No	Abies lasiocarpa/ Symphoricarpos albus	Typic Cryoboralf	Greys River	35N 117W Sec. 14 SESW	Deer Creek
6	9	Yes	1.2	3010	3-8	Northeast	No	Abies lasiocarpa/ Ribes montigenum	Typic and Lithic Cryoboroll	Big Piney	28N 115W Sec. 15 NESE	Pinegrove Ridge
80	12	Yes	1.1	2050	8-15	Southeast	Yes	Abies lasiocarpa/ Symphoricarpos albus	Argic Cryoboroll	Hoback Junction	38N 114W Sec. 13 NESW	Granite Falls
23	21	Yes	.6	2480	20-25	Northeast	Yes	Abies lasiocarpa/ Arnica cordifolia	Mollic and Typic Cryoboralf	Big Piney	42N 112W Sec. 14 SWNE	Makl Creek
56	22	No	1.0	2840	3-10	North	No	Abies lasiocarpa/ Vaccinium scoparium	Mollic Cryoboralf	Gros Ventre	42N 112W Sec. 14 SWNE	Upper Slide Lake
55	28	No	1.3	2830	10-22	North	No	Abies lasiocarpa/ Vaccinium scoparium	Mollic Cryoboralf	Gros Ventre	42N 112W Sec. 11 SESE	Upper Slide Lake
70	33	No	.5	2610	3-10	East	No	Abies lasiocarpa (understory was not sampled due to logging disturbance)	Mollic Cryoboralf	Gros Ventre	44N 113W Sec. 25 SESW	Green Mountain

1/ In 1982.

2/ Steele, R., D. Ondov, S.V. Cooper and R.D. Pfister. 1983. Forest habitat types of eastern Idaho - western Wyoming. U.S.D.A. For. Ser. Res. Pap. int-144. U.S.D.A For. Serv. Intermt. For. and Range Exp. Stn., Ogden, Utah.

3/ Sites without soil classification have not been mapped by Forest Service soil survey.

APPENDIX D

Site Description Narratives - Coniferous Sites

Site 9

Site 9 is located along Deadline Ridge on a northeastern facing bench with a 3-8 % slope (Fig. 29). This bench drains into Middle Sawmill, South Sawmill and Black Canyon Creeks to the east. Undisturbed native vegetation located west of the site was used for comparative sampling (Fig. 30). The site was recontoured and seeded in the spring of 1979, at the time of abandonment. The seed mixture used included Agropyron intermedium, Bromus inermis, Dactylis glomerata, Phleum pratense, each at 5 lbs/a and Trifolium hybridum at 1 lb/a. This site has been fenced using 4 strand barbed wire.

The average annual precipitation is approximately 76 cm at this site with a growing season of approximately 90 days. This area receives large accumulations of snow and intense amounts of solar radiation. Snow usually melts by mid to late June, with winter storms resuming in September or early October. Temperatures below freezing are common throughout the year.

Site 36

This site is located on Middle Ridge, above and east of the Greys River Road. The drill site is approximately 1.6 km southeast of Grizzly Basin on a southwestern facing slope above the Little Elk Creek drainage (Fig. 31). Undisturbed native vegetation located north of the site was used for comparative sampling (Fig. 32). This site was abandoned in 1978. There was no record available concerning post drilling treatment, but the site appeared to have been recontoured and seeded. The seed mixture used probably contained at least Agropyron cristatum, Bromus inermis, Dactylis glomerata and Trifolium pratense based on the presence of these species on the site at the time of sampling.

Site 36 receives approximately 64 cm of precipitation annually. Frost can be expected at any time throughout the year. Average growing season is about 120 days, beginning in late May and extending through mid September. This site is subject to deep snow accumulations and prevailing westerly winds.

Site 6

This site is located approximately 2.5 km northwest of Site 9 along Pine Grove Ridge. Prevailing climate is similar to that described for Site 9. The site is relatively level with only a 3-8 % slope and a slightly northeastern aspect (Fig. 33). Undisturbed native vegetation located west of the site was used for comparative sampling (Fig. 34).

Site 6 was abandoned in September of 1973. There was no record available concerning reclamation practices applied to the area, but due to the rocky nature of the surface it did not appear to have been

topsoiled. A steep embankment was left on the northern section of the drill site, making it questionable as to whether the site had been recontoured. The presence of Bromus inermis as the most dominant grass would indicate that at least this species had been seeded on the site.

Site 80

Site 80 is located north of Highway 187 on the southeastern side of Game Hill. This site is approximately 10 km west of Bondurant. The road to the site has been closed and reseeded, allowing access by foot only. The site was recontoured to a slope of 8-15 %, and has a southeastern aspect (Fig. 35). This site was abandoned in August of 1970 and was seeded, although no record of the seed mixture used was available. It probably contained Bromus inermis and Agropyron intermedium, as evidenced by the presence of these introduced species on the site at the time of sampling. Undisturbed native vegetation located north of the site was used for comparative sampling (Fig. 36).

Average annual precipitation is approximately 51 cm at site 80. The average number of frost free days for the year is three, indicating the cold climate and short growing season experienced in this area.

Site 23

Site 23 is situated on a wooded hillside draining into Little Maki Creek, approximately 0.5 km north of North Cottonwood Creek. The site occupies a 20-25 % northeastern facing slope (Fig. 37). Undisturbed native vegetation located north of the site was used for comparative sampling (Fig. 38). This site was abandoned in November of 1961. No record was maintained concerning post drilling reclamation practices, but the site appeared to have been recontoured with some seed applied. Both Bromus inermis and Phleum pratense (introduced grasses) were conspicuously present on the disturbed site, indicating that they may have been seeded at the time of abandonment.

Average annual precipitation received in the area is approximately 30-35 cm. A freeze can be expected at Site 23 any time throughout the year. The growing season averages approximately 120 days, generally beginning in mid May and extending through mid September.

Site 56

Site 56 is located approximately 1 km southeast of Gunsight Pass. The site is on a north facing slope characterized by a series of benches, with slopes varying from 3-10 % (Fig. 39). Undisturbed native vegetation located west of the site was used for comparative sampling (Fig. 40). This site was abandoned in July of 1960. There were no records available concerning treatment of the site after drilling; therefore, interpretation concerning reclamation practices was inferred through visual observations. The presence of the benches and large amounts of surface rock indicated that the site was not recontoured or topsoil replaced. The dominant grass on the site is a common hybrid thought to be the result of crossing between Agropyron trachycaulum and A. dasystachyum (Cronquist et al., 1977). This species, A.

pseudorepens, is not likely to have been seeded at the time of abandonment and has probably invaded the site naturally. A large quantity of Trifolium pratense was also sampled on the site, but it is believed that this also established by natural means and was not introduced deliberately. Therefore, it was deduced that this site was not seeded at the time of abandonment.

Due to the elevation of this site, prevailing climate is characterized by very long cold winters with extremely low temperatures and average annual precipitation of approximately 76-89 cm. About 60 % of this is received in the form of snow and the remainder as rain. Frost is possible at anytime, making the growing season quite short (approximately 90 days). Snow may be gone by mid-June and cold temperatures can be expected to return in mid-September.

Site 55

This site is located approximately 0.5 km directly north of site 56. Prevailing climate is the same as that previously described for Site 56. Site 55 has a northern aspect and a 10-22 % slope (Fig. 41). Undisturbed native vegetation located north of the site was used for comparative sampling (Fig. 42). This site was abandoned in December of 1954. The disturbed area was not recontoured, as evidenced by the benches, slopes and gullys characterizing its topography. Judging from the vegetation cover on the site, it was deduced that seed had not been applied at the time of abandonment.

Site 70

Site 70 is located 0.5 km south of Skull Creek meadows. The site itself is a level bench with steeply sloping sides on the northern and eastern edge. The drilling site has an eastern exposure and a 3-10 % slope (Fig. 43). This site was abandoned in October of 1949, and it did not receive any postdrilling reclamation treatment.

This site has not been included in the composite discussion of the coniferous sites because it became apparent, upon investigation, that much of the surrounding native vegetation had been disturbed to some extent by logging equipment (Fig. 44). There was no area adjacent to the site suitable for comparative native vegetation sampling. Vegetation data were collected on the disturbed site simply to gain an insight into which species occurred on a site of this age. However, soil was sampled, on both disturbed and native areas. A representative spot was found on the native area which did not appear to have been disturbed by logging equipment or operations. The disturbed and native soil data were included in the overall discussion of soils data form the coniferous sites. Site 70 can be expected to receive approximately 63-76 cm of annual precipitation, with the growing season averaging 100 to 120 days.

APPENDIX D

Photographs of Coniferous Disturbances and Associated Native Vegetation

FIGURE 29
SITE 9 - REFERENCE PHOTO TAKEN NEXT TO LARGE ENGLEMAN SPRUCE ON WESTERN EDGE OF SITE, DRILL PIPE IS 70° EAST OF PHOTO POINT. DATE 8-19-82.

FIGURE 30
SITE 9 - VIEW OF ADJACENT NATIVE COMMUNITY, LOCATED WEST OF SITE, USED FOR UNDISTURBED SAMPLING. DATE 8-19-82.

FIGURE 31
SITE 36 - REFERENCE PHOTO TAKEN FROM SLOPE ON NORTHEASTERN EDGE OF SITE, DRILL PIPE IS 236° SOUTHWEST OF PHOTO POINT. DATE 7-12-82.

FIGURE 32
SITE 36 - VIEW OF ADJACENT NATIVE COMMUNITY, LOCATED NORTH OF SITE, USED FOR UNDISTURBED SAMPLING. DATE 7-10-82.

FIGURE 33
SITE 6 - REFERENCE PHOTO TAKEN FROM SHALE CLIFF ON NORTHERN EDGE OF SITE, DRILL PIPE IS 150° SOUTH OF PHOTO POINT. DATE 8-11-82.

FIGURE 34
SITE 6 - VIEW OF ADJACENT NATIVE COMMUNITY, LOCATED WEST OF SITE, USED FOR UNDISTURBED SAMPLING. DATE 8-11-82.

FIGURE 35
SITE 80 - REFERENCE PHOTO TAKEN FROM WESTERN EDGE OF SITE, DRILL PIPE IS 272° EAST OF PHOTO POINT. DATE 6-25-82.

FIGURE 36
SITE 80 - VIEW OF ADJACENT NATIVE COMMUNITY, LOCATED NORTH OF SITE, USED FOR UNDISTURBED SAMPLING. DATE 6-24-82.

FIGURE 37
SITE 23 - REFERENCE PHOTO TAKEN FROM SOUTHEASTERN EDGE OF SITE, DRILL PIPE IS 298° NORTHWEST OF PHOTO POINT. DATE 7-26-82.

FIGURE 38
SITE 23 - VIEW OF ADJACENT NATIVE COMMUNITY, LOCATED NORTH OF SITE, USED FOR UNDISTURBED SAMPLING. DATE 7-24-82.

FIGURE 39
SITE 56 - REFERENCE PHOTO TAKEN FROM WESTERN SLOPE OVERLOOKING SITE, DRILL PIPE IS 58° EAST OF PHOTO POINT. DATE 8-7-82.

FIGURE 40
SITE 56 - VIEW OF ADJACENT NATIVE COMMUNITY, LOCATED WEST OF SITE, USED FOR UNDISTURBED SAMPLING. DATE 8-6-82.

FIGURE 41
SITE 55 - REFERENCE PHOTO TAKEN FROM SLOPE OVERLOOKING SITE, DRILL PIPE IS 40° NORTHEAST OF [illegible] POINT. DATE 8-9-82.

FIGURE 42
SITE 55 - VIEW OF ADJACENT NATIVE COMMUNITY, LOCATED NORTH OF SITE, USED FOR UNDISTURBED SAMPLING. DATE 8-9-82.

FIGURE 43
SITE 70 - REFERENCE PHOTO TAKEN FROM SOUTHERN SLOPE OVERLOOKING SITE, DRILL PIPE IS DUE NORTH OF PHOTO POINT. DATE 8-4-82.

FIGURE 44
SITE 70 - VIEW OF ADJACENT NATIVE COMMUNITY. DATE 6-30-82.

APPENDIX D

Data for Coniferous Sites

TABLE 14. Mean estimated (%) plant class canopy cover, ground cover and species canopy cover for all coniferous sites, 1982.

	Site 9		Site 36		Site 6		Site 80		Site 23		Site 56		Site 55		Site 70	
	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site.	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site*
A. PLANT CLASS[1/]																
Total Vegetation	19.0[a2/]	25.7[a]	43.4[a]	44.5[a]	15.0[b]	26.3[a]	30.4[b]	51.7[a]	36.0[a]	23.1[b]	31.6[b]	81.1[a]	46.5[a]	50.1[a]	55.5	-
Perennial Grasses & Grasslikes	16.5[a]	3.1[b]	37.4[a]	4.0[b]	11.8[a]	3.8[b]	15.8[a]	5.3[b]	13.2	0	8.2[a]	.1[b]	11.4[a]	.3[b]	23.8	-
Annual Grasses	.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
Perennial Forbs	.5[b]	13.6[a]	2.2[b]	28.8[a]	2.5[b]	9.8[a]	4.4[b]	35.5[a]	18.4[a]	9.9[b]	11.8[b]	22.8[a]	18.5[a]	19.8[a]	21.0	-
Annual Forbs	2.1[a]	.2[b]	3.0[a]	.2[b]	1.3[a]	T[b]	6.8[a]	2.9[b]	.1	0	.4	0	.3	0	4.1	-
Leguminous Forbs	T[3/]	4.2[a]	1.0[a]	2.3[a]	.3[b]	7.0[a]	2.5[b]	6.1[a]	2.3	0	9.7[a]	2.3[b]	12.2[a]	1.2[b]	11.0	-
Shrubs & Tree Seedlings[4/]	.1[b]	7.0[a]	.3[b]	13.2[a]	0	8.6	0	5.2	3.4[b]	16.1[a]	1.4[b]	40.1[a]	2.5[b]	28.5[a]	T	-
B. INDIVIDUAL PLANT SPECIES																
1. Perennial Grasses & Grasslikes																
Agropyron albicans	.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Agropyron caninum	-	-	-	-	-	-	-	.7	-	-	-	-	-	-	-	-
Agropyron cristatum	-	-	3.8	-	-	-	-	-	-	-	-	-	-	-	-	-
Agropyron intermedium	1.2	-	-	-	-	-	2.2	-	-	-	-	-	-	-	.2	-
Agropyron pseudorepens	-	-	-	-	-	-	-	-	-	-	4.6	-	-	-	-	-
Agropyron smithii	-	-	-	-	-	-	1.2	-	-	-	-	-	-	-	-	-
Agropyron trachycaulum	7.2	.4	T	.2	.2	.1	-	-	.1	-	-	-	-	-	1.0	-
Agropyron spp. #1	.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Agropyron spp. #2	2.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Agropyron spp.	-	-	-	-	-	-	-	-	-	-	-	-	3.9	-	-	-
Agrostis idahoensis	-	-	-	-	-	-	-	-	-	-	-	-	.2	-	-	-
Bromus anomalus	-	-	-	T	-	-	-	-	-	-	-	-	-	-	-	-
Bromus carinatus	-	-	-	-	-	-	-	1.0	-	-	-	-	-	-	-	-
Bromus inermis	1.5	-	13.0	-	11.3	-	11.8	-	8.2	-	.5	-	.1	-	14.1	-
Bromus marginatus	-	-	-	.1	-	-	-	-	-	-	-	-	-	-	-	-
Calamagrostis rubescens	-	-	-	2.5	-	T	-	-	-	-	-	-	-	-	-	-
Dactylis glomerata	4.2	-	20.8	-	-	-	-	-	-	-	-	-	-	-	-	-
Elymus canadensis	-	-	-	-	-	-	-	-	-	-	-	-	T	-	-	-
Elymus glaucus	-	-	-	.2	-	-	-	-	-	-	-	-	-	-	-	-
Festuca arundinaceae	.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Festuca idahoensis	-	-	-	-	-	-	-	1.1	-	-	-	-	.3	-	-	-
Hesperochloa kingii	-	-	-	-	-	.8	-	-	-	-	-	-	-	-	-	-
Hordeum brachyantherum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	T	-
Hordeum jubatum	.1	-	-	-	-	-	-	-	-	-	-	-	-	-	T	-
Koeleria cristata	-	-	-	-	-	-	-	.4	-	-	-	-	-	-	-	-
Melica spectabolis	-	-	-	.1	-	-	-	.1	-	-	-	-	-	-	-	-
Phleum alpinum	-	-	-	-	-	-	-	.1	-	-	-	-	.2	-	-	-

TABLE 14 (cont.):

	Site 9		Site 36		Site 6		Site 80		Site 23		Site 56		Site 55		Site 70	
	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site
B. INDIVIDUAL PLANT SPECIES - Cont.																
1. Perennial Grasses & Grasslikes - Cont.																
Phleum pratense	-	-	-	-	.1	-	-	-	3.4	-	-	-	-	-	2.1	-
Poa canbyi	-	-	-	-	-	-	-	-	-	-	-	-	1.2	-	-	-
Poa curta	-	1.5	-	-	-	1.6	-	.6	-	-	.3	-	1.3	-	-	-
Poa cusickii	.2	.4	-	-	-	.6	-	-	-	-	-	-	-	-	-	-
Poa fendleriana	-	-	-	-	-	-	-	.1	-	-	-	-	-	-	-	-
Poa nervosa	-	.4	.1	.1	-	-	-	-	-	-	-	.1	-	.3	-	-
Poa palustris	-	-	-	-	-	-	-	.2	-	-	.1	-	-	-	-	-
Poa pratensis	-	-	-	-	-	-	.8	1.0	.1	-	-	-	2.0	-	2.9	-
Poa reflexa	T	-	-	-	.1	-	-	-	-	-	-	-	-	-	-	-
Poa spp.	T	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stipa columbiana	-	-	-	-	-	T	-	-	-	-	-	-	-	-	-	-
Stipa spp.	-	-	-	-	-	-	-	-	-	-	-	-	.3	-	-	-
Trisetum spicatum	T	.3	-	.1	.1	.7	-	-	-	-	.2	-	1.5	-	-	-
Unknown Grass	-	-	-	-	-	-	-	.1	-	-	.1	-	.1	.1	-	-
Carex brevipes	-	-	.8	1.7	-	-	-	-	-	-	-	-	-	-	-	-
Carex microptera	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.4	-
Carex rossii	.4	.7	-	-	-	-	-	-	2.3	-	2.1	-	-	.2	-	-
Carex spp.	-	-	-	-	-	.1	-	.5	-	-	-	-	.3	-	-	-
Equisetum fluviatile	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.5	-
Scirpus spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.1	-
Summed Cover	18.0	3.7	38.5	5.0	11.8	3.9	16.0	5.9	14.1	-	7.9	.1	11.4	.6	25.3	-
B. INDIVIDUAL PLANT SPECIES - Cont.																
2. Annual Grasses																
Bromus tectorum	.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3. Perennial Forbs																
Achillea millefolium	-	1.3	1.1	.8	.1	1.2	.3	1.1	3.5	-	.6	-	2.8	-	.7	-
Agoseris glauca	-	.4	-	-	-	-	-	-	-	-	.2	-	-	-	-	-
Agoseris spp.	-	.8	-	-	-	-	-	.5	.1	-	-	-	.1	.1	.2	-
Antennaria anaphaloides	-	-	-	-	-	.2	-	-	-	-	-	-	-	-	-	-
Antennaria microphylla	-	.2	-	-	-	T	-	.4	2.5	-	.4	-	.1	-	-	-
Antennaria racemosa	-	-	-	-	-	-	-	-	-	-	1.0	6.0	.1	3.3	-	-

TABLE 14 (cont.):

	Site 9		Site 36		Site 6		Site 80		Site 23		Site 56		Site 55		Site 70	
	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site
B. INDIVIDUAL PLANT SPECIES - Cont.																
3. Perennial Forbs - Cont.																
Aquilegia caerulea	-	-	-	.2	-	.2	-	-	-	.1	-	.3	-	-	-	-
Arabis spp.	.1	.1	-	-	T	.1	-	.1	.5	-	.4	-	.2	-	.6	-
Arenaria congesta	T	.8	-	-	-	.6	-	2.2	-	-	-	-	.2	-	-	-
Arnica cordifolia	-	4.1	.1	8.4	-	.2	-	.1	.2	7.3	-	12.6	T	9.8	-	-
Aster foliaceus	-	-	-	-	-	-	3.2	2.7	-	-	6.5	-	9.3	-	3.5	-
Aster spp.	-	-	-	-	-	-	-	-	-	-	.2	-	-	-	-	-
Castelleja spp.	.1	-	-	-	-	.1	-	-	-	-	-	-	-	-	-	-
Chaenactis douglasii	-	-	-	-	.1	-	-	-	-	-	-	-	-	-	-	-
Circium spp.	-	-	.3	-	-	-	-	-	.8	-	.1	-	.1	-	-	-
Claytonia lanceolata	-	-	-	-	-	-	-	.8	-	-	-	-	-	-	-	-
Clarkia spp.	-	-	-	-	-	-	-	-	-	-	-	-	.1	-	-	-
Comandra rotundifolia	-	-	-	-	-	-	-	-	-	-	.1	-	-	-	-	-
Crepis spp.	-	-	.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Delphinium nuttallii	-	-	-	-	-	-	-	.4	-	-	-	-	-	-	-	-
Delphinium occidentale	-	-	-	-	-	.3	.1	-	-	-	-	-	-	-	-	-
Draba spp.	.2	T	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Epilobium angustifolium	-	-	.1	.5	-	.1	-	-	-	-	.1	2.1	.2	4.4	-	-
Epilobium brevistylum	-	-	.5	-	-	-	-	-	-	-	-	-	.1	-	-	-
Erigeron canus	-	-	-	-	-	.4	-	-	-	-	-	-	-	-	-	-
Erigeron eatonii	.1	.2	-	-	.4	1.9	-	-	.2	-	-	-	-	-	-	-
Erigeron peregrinus	-	-	-	-	-	-	-	-	-	-	.3	-	.4	2.6	-	-
Erigeron speciosus	-	.2	-	-	-	-	-	-	T	-	-	-	-	-	-	-
Eriogonum umbellatum	-	-	-	-	-	-	-	.5	-	-	.5	-	.1	-	-	-
Eriophyllum lanatum	-	-	-	-	-	-	-	-	-	-	.6	-	-	-	-	-
Fragaria virginiana	-	-	.2	2.7	-	-	.1	4.3	1.2	-	-	-	-	-	T	-
Fragaria spp.	-	-	-	-	-	-	-	.1	-	-	-	-	-	-	-	-
Frasera speciosa	-	.7	-	-	-	.1	-	-	-	-	-	.4	-	-	-	-
Gallium boreale	-	-	.1	.1	-	-	-	.1	-	-	-	-	-	-	T	-
Geranium richardsonii	-	-	-	5.4	-	-	-	-	-	-	-	-	-	-	-	-
Geranium viscosissimum	-	.6	-	-	-	.5	-	3.9	-	1.5	-	-	-	-	-	-
Gilia aggregata	-	-	-	-	-	-	-	.1	-	-	.1	-	-	-	-	-
Helenium hoopesii	-	-	-	-	-	-	-	.5	-	-	-	-	-	-	-	-
Hieracum albiflorum	-	-	-	-	-	-	-	-	.1	-	-	-	-	-	-	-
Hydrophyllum capitatum	-	-	T	.2	-	-	-	.6	-	-	-	-	-	-	-	-
Lactuca spp.	T	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ligusticum filicinum	-	-	-	.2	-	-	-	-	-	-	.1	.3	-	T	-	-
Lithophragma parviflora	-	-	-	-	-	-	-	.7	-	-	-	-	-	-	-	-
Lomatium nuttallii	-	-	-	-	-	.2	-	-	-	-	-	-	-	-	-	-
Mertensia oblongifolia	-	-	-	-	-	-	-	.6	-	-	-	-	-	-	-	-
Mertensia spp.	-	.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Microseris spp.	-	-	-	-	-	-	-	.3	-	-	-	-	-	-	-	-

TABLE 14 (cont.):

	Site 9		Site 36		Site 6		Site 80		Site 23		Site 56		Site 55		Site 70	
	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site
B. INDIVIDUAL PLANT SPECIES - Cont.																
3. Perennial Forbs - Cont.																
Orogenia linearifolia	-	-	-	-	-	-	T	.1	-	-	-	-	-	-	-	-
Osmorhiza chilensis	-	-	-	2.2	-	.5	-	-	-	.1	-	.2	-	.4	-	-
Pedicularis bracteosus	-	-	-	.2	-	-	-	-	-	-	-	-	-	-	-	-
Perideridia gairdneri	-	-	-	-	-	-	-	.7	T	-	-	-	-	-	-	-
Phacelia sericeus	.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phlox longifolia	-	.3	-	-	-	.1	-	1.0	-	-	-	-	-	-	-	-
Potentilla diversifolia	-	.1	-	-	-	-	-	.1	-	-	-	-	-	-	-	-
Potentilla glandulosa	-	-	-	-	-	-	-	.2	-	-	-	-	-	-	-	-
Potentilla gracilis	-	.7	-	.1	-	-	.1	3.5	.1	-	-	-	.1	-	-	-
Pyrola elliptica	-	-	-	-	-	-	-	-	-	.1	-	-	-	-	-	-
Pyrola secunda	-	-	-	.5	-	-	-	-	-	.9	-	.3	-	.1	-	-
Ranunculus jovis	-	.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ranunculus sardous	-	-	.2	-	-	-	-	-	-	-	-	-	-	-	-	-
Ranunculus spp.	-	-	-	-	-	-	-	T	-	-	-	-	-	-	-	-
Rumex pauciflius	-	-	-	-	-	-	-	1.1	-	-	-	-	-	-	-	-
Rumes salicifolius	-	-	-	-	.1	-	-	-	-	-	-	-	-	-	-	-
Sedum stenopetalum	-	-	-	-	-	T	-	-	-	-	-	-	-	-	-	-
Senecio crassulus	-	-	-	-	-	.3	-	-	-	-	.3	-	-	-	-	-
Senecio dimorphophyllus	-	.1	-	-	-	-	-	.5	-	-	.1	-	-	-	-	-
Senecio integerrimus	-	1.9	T	-	-	-	-	1.4	-	-	-	-	.2	-	-	-
Senecio serra	-	-	-	.4	-	-	-	.2	-	-	-	-	-	-	-	-
Senecio spp.	-	-	-	.2	-	-	-	-	-	-	-	-	-	-	-	-
Silene spp.	-	.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sisyrinchium angustifolium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.1	-
Smilacina spp.	-	-	-	.1	-	-	-	-	-	-	-	-	-	-	-	-
Solidago canadensis	-	-	-	-	-	-	-	-	3.7	-	-	-	-	-	-	-
Solidago multiradiata	-	-	-	-	-	-	-	-	-	-	.5	-	.4	-	-	-
Stellaria jamesiana	-	-	.1	.9	-	-	-	-	-	-	-	-	-	-	-	-
Tanacetum nuttallii	-	-	-	-	-	-	-	-	.3	-	-	-	-	-	-	-
Taraxacum officinale	-	.5	.1	.2	1.4	.5	1.1	3.4	5.6	-	1.8	-	6.1	-	14.5	-
Thalictrum occidentale	-	-	-	4.7	-	-	-	.4	-	.1	-	.9	-	.2	-	-
Townsendia alpigena	-	-	-	-	-	.1	-	-	-	-	-	-	-	-	-	-
Tragopogon dubius	-	-	-	-	-	-	.2	.1	.1	-	-	-	-	-	-	-
Valeriana occidentalis	-	-	-	-	-	-	-	1.0	-	-	-	-	-	-	-	-
Viola adunca	-	-	-	.6	-	-	-	.3	-	-	-	-	-	-	-	-
Viola nuttallii	-	.9	-	.8	-	1.2	-	2.2	-	-	-	-	-	-	-	-
Viola spp.	.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wyethia amplexicaulis	-	-	-	-	-	-	-	5.9	-	-	-	-	-	-	-	-
Unknown Perennial	-	.1	-	-	-	-	-	-	-	-	-	.6	-	-	-	-
Perennial #1	-	-	-	-	-	-	-	T	-	-	-	-	-	-	-	-

TABLE 14 (cont.):

	Site 9		Site 36		Site 6		Site 80		Site 23		Site 56		Site 55		Site 70	
	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site*
B. INDIVIDUAL PLANT SPECIES - Cont.																
3. Perennial Forbs - Cont.																
Perennial #9	-	-	-	T	-	-	-	.1	-	-	-	-	-	-	-	-
Perennial #10	-	-	-	-	-	-	T	-	-	-	-	-	-	-	-	-
Perennial #19	-	-	-	1.3	-	-	-	-	-	-	-	-	-	-	-	-
Perennial #20	-	-	-	.2	-	-	-	-	-	-	-	-	-	-	-	-
Perennial #21	-	-	-	1.6	-	-	-	-	-	-	-	-	-	-	-	-
Perennial #22	-	-	-	-	-	-	T	.2	-	-	-	-	-	-	-	-
Perennial #23	-	-	-	-	-	-	-	.9	-	-	-	-	-	-	-	-
Perennial #25	-	-	-	-	-	-	-	.1	-	-	-	-	-	-	-	-
Perennial #26	-	-	-	T	-	-	-	-	-	-	-	-	-	-	-	-
Perennial #27	-	-	-	-	-	-	-	.1	-	-	-	-	-	-	-	-
Perennial #28	-	-	-	.5	-	-	-	-	-	-	-	-	-	-	-	-
Perennial #29	-	-	-	2.0	-	-	-	-	-	-	-	-	-	-	-	-
Summed Cover	.7	14.6	2.9	35.0	2.1	8.8	5.1	43.5	18.9	10.1	13.9	23.7	20.6	20.9	-	-
4. Annual Forbs																
Androsace septentrionalis	.7	T	-	T	T	.1	-	.4	-	-	-	-	.1	-	-	-
Atriplex spp.	.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chenopodium spp.	-	-	T	-	T	-	-	-	-	-	-	-	-	-	-	-
Chrysopsis villosa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.5	-
Collinsia parviflora	.1	-	1.1	-	-	-	-	.8	T	-	-	-	-	-	-	-
Collomia linearis	.1	-	.2	.2	T	-	.2	.4	T	-	.1	-	.1	-	1.2	-
Cruciferae spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.5	-
Descurainia spp.	-	-	-	-	.1	-	-	-	-	-	-	-	-	-	-	-
Draba spp.	-	-	-	-	-	-	-	.3	-	-	-	-	-	-	-	-
Epilobium paniculatum	-	-	.1	-	.1	-	.6	.2	T	-	.1	-	-	-	.4	-
Epilobium spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.2	-
Gallum bifolium	T	-	.1	T	-	-	-	.3	-	-	-	-	-	-	T	-
Gayophytum diffusum	-	-	.3	-	-	-	-	-	-	-	-	-	-	-	-	-
Linanthus harknessii	-	-	-	-	-	T	.1	T	T	-	-	-	-	-	-	-
Matricaria maritima	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.1	-
Monolepsis nuttalliana	.6	-	-	-	.5	-	-	-	-	-	-	-	-	-	-	-
Nemophila breviflora	-	-	-	-	-	-	-	1.1	-	-	-	-	-	-	-	-
Polygonum arviculare	-	+	-	-	.2	-	-	-	-	-	-	-	-	-	-	-
Polygonum confertifolium	-	-	-	-	-	-	-	-	-	-	T	-	-	-	-	-
Polygonum douglasii	.4	-	1.6	-	.2	-	-	.2	T	-	.3	-	.1	-	-	-
Polygonum sawatchense	.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE 14 (cont.):

	Site 9		Site 36		Site 6		Site 80		Site 23		Site 56		Site 55		Site 70	
	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site
B. INDIVIDUAL PLANT SPECIES - Cont.																
4. Annual Forbs - Cont.																
Veronica biloba	-	-	-	-	-	-	.5	-	-	-	-	-	-	-	-	-
Annual #3	-	-	T	-	-	-	-	-	-	-	-	-	-	-	-	-
Annual #6	-	-	-	-	.4	-	-	-	-	-	-	-	-	-	-	-
Annual #10	-	-	-	-	-	-	6.5	-	-	-	-	-	-	-	.1	-
Annual #12	-	-	-	-	-	-	T	-	-	-	-	-	-	-	-	-
Annual #15	-	-	-	-	-	-	-	.1	-	-	-	-	-	-	-	-
Annual #25	-	-	T	-	-	-	-	-	-	-	-	-	-	-	-	-
Annual #26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.7	-
Summed Cover	2.3	-	3.4	.2	1.5	.1	7.9	3.8	-	-	.5	-	.3	-	3.7	-
5. Leguminous Forbs																
Astragalus miser	T	.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Astragalus spp.	-	-	-	-	-	4.8	-	.1	-	-	-	-	-	-	.4	-
Lupinus argenteus	-	3.7	-	-	-	2.0	-	-	-	-	.4	2.3	.9	1.1	-	-
Lupinus caudatus	-	-	-	-	-	-	-	.4	-	-	-	-	-	-	-	-
Lupinus sericeus	-	-	-	-	-	-	-	.1	-	-	-	-	-	-	-	-
Lupinus wyethia	-	-	.2	2.3	-	-	-	-	-	-	-	-	-	-	-	-
Trifolium gymnocarpon	-	-	-	-	-	-	.1	2.8	-	-	-	-	-	-	-	-
Trifolium longipes	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-
Trifolium pratense	-	-	.8	-	-	-	-	-	2.2	-	9.3	-	10.8	-	8.3	-
Trifolium spp. #1	-	-	-	-	-	-	2.2	-	-	-	-	-	-	-	-	-
Trifolium spp. #2	-	-	-	-	-	-	.2	-	-	-	-	-	-	-	-	-
Trifolium spp.	-	-	-	-	.3	-	-	-	-	-	-	-	.4	-	1.6	-
Summed Cover	-	4.3	1.0	2.3	.3	6.8	2.5	5.9	2.2	-	9.7	2.3	12.1	1.1	10.3	-
6. Shrub and Tree Seedlings																
Abies lasiocarpa	T	7.0	-	4.3	-	7.9	-	2.2	.3	11.7	T	7.4	1.7	3.7	-	-
Amelanchier alnifolia	-	-	-	.2	-	-	-	.2	-	.1	-	-	-	-	-	-
Artemisia cana	-	-	-	-	-	-	-	.2	-	-	-	-	-	-	-	-
Artemisia tridentata var. vaseyana	.1	-	-	-	-	.2	-	.7	.9	-	-	-	-	-	-	-
Berberis repens	-	-	-	-	-	-	-	.4	-	-	-	-	-	-	-	-

TABLE 14 (cont.):

	Site 9		Site 36		Site 6		Site 80		Site 23		Site 56		Site 55		Site 70	
	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site*
B. INDIVIDUAL PLANT SPECIES - Cont.																
6. Shrub and Tree Seedlings - Cont.																
Lonicera utahensis	-	-	-	1.4	-	-	-	-	-	-	-	-	-	.3	-	-
Pachistima myrsinites	-	-	-	1.0	-	-	-	.2	-	11.6	-	-	-	-	-	-
Picea engelmanni	-	-	-	-	-	-	-	-	-	-	.3	.8	.3	-	-	-
Pinus albicaulis	-	-	-	-	-	-	-	-	-	-	-	.2	-	.6	-	-
Pinus contorta	-	-	-	-	-	-	-	-	2.2	-	1.2	-	-	-	T	-
Pseudotsuga menziesii	-	-	-	.5	-	-	-	-	-	-	-	-	-	-	-	-
Ribes montigenum	-	-	-	-	-	1.3	-	-	-	-	-	.3	-	.2	-	-
Ribes viscosissimum	-	-	.3	.9	-	-	-	-	.3	.3	-	-	-	-	-	-
Rosa woodsii	-	-	-	.8	-	-	-	.2	-	-	-	-	-	-	-	-
Salix spp.	-	-	-	-	-	-	-	-	-	-	-	-	.2	-	-	-
Shepherdia canadensis	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-
Sorbus scopulina	-	-	-	1.5	-	-	-	-	-	-	-	-	-	-	-	-
Symphoricarpos albus	-	-	-	-	-	-	-	.9	-	-	-	-	-	-	-	-
Symphoricarpos oreophilus	-	-	-	3.6	-	-	-	-	-	-	-	-	-	-	-	-
Vaccinium scoparium	-	-	-	-	-	-	-	T	-	-	-	33.5	-	25.8	-	-
Summed Cover	.1	7.0	.3	14.2	-	9.4	-	5.0	3.7	26.2	1.5	42.2	2.2	30.6	-	-
7. Total Summed Cover	21.2	29.6	46.1	56.7	15.7	29.0	31.5	64.1	38.9	36.3	33.5	68.3	46.6	53.2	58.9	-
C. GROUND COVER																
Bareground	87.0[a]	12.4[b]	56.8[a]	1.5[b]	87.6[a]	12.2[b]	68.4[a]	25.9[b]	45.0	0	62.5[a]	.7[b]	47.3[a]	3.4[b]	39.3	-
Litter	6.0[b]	82.1[a]	23.3[b]	85.9[a]	7.2[b]	79.9[a]	17.8[b]	53.9[a]	36.5[b]	89.5[a]	27.7[b]	86.8[a]	33.6[b]	87.1[a]	40.0	-
Moss/Lichen	0	1.0	.5[b]	7.7[a]	.1[b]	2.0[a]	0	.4	6.2[a]	8.5[a]	.3[b]	2.3[a]	1.9[a]	.9[a]	.3	-
Basal Stems	7.0[a]	4.5[b]	19.4[a]	4.9[b]	5.1[a]	5.9[a]	13.8[b]	19.8[a]	12.3[a]	2.0[b]	9.5[a]	10.2[a]	17.2[a]	8.6[b]	20.4	-
Small Rocks (<2 cm)	30.9[a]	3.4[b]	3.5[a]	.2[b]	7.2[a]	.9[b]	1.5[a]	.7[b]	4.8	0	13.1	0	2.6	0	2.6	-
Medium Rocks (2-30 cm)	36.6[a]	4.5[b]	10.0[a]	2.1[b]	30.4[a]	3.6[b]	2.7[a]	.8[b]	7.4	0	29.0	0	7.2[a]	.1[b]	4.4	-
Large Rocks (>30 cm)	.5	0	2.9[a]	.4[a]	0	.5	0	0	0	0	0	0	0	0	0	-

1/ Independently estimated; i.e., not summed parameters.

2/ Values between disturbed-native site pairs followed by the same letter are not significantly different at the .05 level (T-test).

3/ T = trace; i.e., less than 0.1 percent.

4/ Trees <140 cm in height.

* Native vegetation was not sampled on Site 70.

TABLE 15. Frequency of occurence for plant classes, species and ground cover on all coniferous sites, 1982.

	Site 9		Site 36		Site 6		Site 80		Site 23		Site 56		Site 55		Site 70	
	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site
A. PLANT CLASS[1/]																
Total Vegetation	100	100	100	100	100	100	100	100	100	97.5	100	100	100	97.5	100	-
Perennial Grasses & Grasslikes	100	87.5	100	97.5	67.5	82.5	100	97.5	100	0	95	2.5	97.5	15	95	-
Annual Grasses	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Perennial Forbs	37.5	87.5	62.5	97.5	52.5	87.5	72.5	100	100	95	97.5	100	100	95	100	-
Annual Forbs	65	22.5	92.5	37.5	62.5	12.5	90	90	30	0	52.5	0	15	0	82.5	-
Leguminous Forbs	5	47.5	25	55	7.5	80	82.5	95	35	0	52.5	40	77.5	25	82.5	-
Shrubs & Tree Seedlings[2/]	5	45	10	72.5	0	42.5	0	50	25	85	20	100	15	82.5	2.5	-
Tree Canopy[3/]	0	67.5	0	67.5	0	57.5	0	35	0	77.5	0	85	0	82.5	0	-
B. INDIVIDUAL PLANT SPECIES																
1. Perennial Grasses & Grasslikes																
Agropyron albicans	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Agropyron caninum	-	-	-	-	-	-	-	50	-	-	-	-	-	-	-	-
Agropyron cristatum	-	-	82.5	-	-	-	-	-	-	-	-	-	-	-	-	-
Agropyron intermedium	27.5	-	-	-	-	-	62.5	-	-	-	-	-	-	-	7.5	-
Agropyron pseudorepens	-	-	-	-	-	-	-	-	-	-	77.5	-	-	-	-	-
Agropyron smithii	-	-	-	-	-	-	32.5	-	-	-	-	-	-	-	-	-
Agropyron trachycaulum	85	22.5	2.5	17.5	12.5	5	-	-	2.5	-	-	-	-	-	20	-
Agropyron spp. #1	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Agropyron spp. #2	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Agropyron spp.	-	-	-	-	-	-	-	-	-	-	-	-	62.5	-	-	-
Agrostis idahoensis	-	-	-	-	-	-	-	-	-	-	-	-	7.5	-	-	-
Bromus anomalus	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-
Bromus carinatus	-	-	-	-	-	-	-	47.5	-	-	-	-	-	-	-	-
Bromus inermis	55	-	92.5	-	62.5	-	97.5	-	72.5	-	12.5	-	2.5	-	75	-
Bromus marginatus	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-
Calamagrostis rubescens	-	-	-	60	-	2.5	-	-	-	-	-	-	-	-	-	-
Dactylis glomerata	85	-	100	-	-	-	-	-	-	-	-	-	-	-	-	-
Elymus canadensis	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-
Elymus glaucus	-	-	-	12.5	-	-	-	-	-	-	-	-	-	-	-	-
Festuca arundinaceae	7.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Festuca idahoensis	-	-	-	-	-	-	-	47.5	-	-	-	-	5	-	-	-
Hesperachloa kingii	-	-	-	-	-	35	-	-	-	-	-	-	-	-	-	-
Hordeum brachyantherum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-
Hordeum jubatum	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-
Koeleria cristata	-	-	-	-	-	-	-	32.5	-	-	-	-	-	-	-	-
Melica spectabolis	-	-	-	15	-	-	-	10	-	-	-	-	-	-	-	-
Phleum alpinum	-	-	-	-	-	-	-	10	-	-	-	-	5	-	-	-

TABLE 15 (cont.)

	Site 9		Site 36		Site 6		Site 80		Site 23		Site 56		Site 55		Site 70	
	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site
B. INDIVIDUAL PLANT SPECIES - Cont.																
1. Perennial Grasses & Grasslikes - Cont.																
Phleum pratense	-	-	-	-	2.5	-	-	-	77.5	-	-	-	-	-	37.5	-
Poa canbyi	-	-	-	-	-	-	-	-	-	-	-	-	20	-	-	-
Poa curta	-	70	-	-	-	60	-	7.5	-	-	12.5	-	37.5	-	-	-
Poa cusickii	7.5	27.5	-	-	-	20	-	-	-	-	-	-	-	-	-	-
Poa fendleriana	-	-	-	-	-	-	-	7.5	-	-	-	-	-	-	-	-
Poa nervosa	-	20	7.5	5	-	-	-	-	-	-	-	2.5	-	10	-	-
Poa palustris	-	-	-	-	-	-	-	12.5	-	-	2.5	-	20	-	-	-
Poa pratensis	-	-	-	-	-	-	7.5	27.5	2.5	-	-	-	-	-	32.5	-
Poa reflexa	2.5	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-
Poa spp.	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stipa columbiana	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-
Stipa spp.	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-
Trisetum spicatum	2.5	17.5	-	12.5	5	42.5	-	-	-	-	10	-	37.5	-	-	-
Unknown Grass	-	-	-	-	-	-	-	5	-	-	2.5	-	2.5	2.5	-	-
Carex brevipes	-	-	30	57.5	-	-	-	-	-	-	-	-	-	-	-	-
Carex micropterа	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12.5	-
Carex rossii	22.5	35	-	-	-	-	-	-	65	-	22.5	-	-	7.5	-	
Carex spp.	-	-	-	-	-	2.5	-	27.5	-	-	-	-	5	-	-	-
Equisetum fluviatile	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	-
Scirpus spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-
2. Annual Grasses																
Bromus tectorum	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3. Perennial Forbs																
Achillea millefolium	-	55	37.5	22.5	7.5	37.5	15	42.5	82.5	-	35	-	85	-	17.5	-
Agoseris glauca	-	27.5	-	-	-	-	-	-	-	-	7.5	-	-	-	-	-
Agoseris spp.	-	27.5	-	-	-	-	-	27.5	15	-	-	-	12.5	2.5	5	-
Antennaria anaphaloides	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-
Antennaria microphylla	-	7.5	-	-	-	5	-	15	30	-	17.5	-	2.5	-	-	-
Antennaria racemosa	-	-	-	-	-	-	-	-	-	-	22.5	50	2.5	35	-	-

TABLE 15 (cont.):

	Site 9		Site 36		Site 6		Site 80		Site 23		Site 56		Site 55		Site 70	
	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site
B. INDIVIDUAL PLANT SPECIES - Cont.																
3. Perennial Forbs - Cont.																
Aquilegia caerulea	-	-	-	5	-	10	-	-	-	2.5	-	5	-	-	-	-
Arabis spp.	2.5	7.5	-	-	2.5	15	-	15	32.5	-	57.5	-	17.5	-	35	-
Arenaria congesta	2.5	30	-	-	-	30	-	57.5	-	-	-	-	5	-	-	-
Arnica cordifolia	-	47.5	2.5	77.5	-	7.5	-	2.5	5	65	-	97.5	5	85	-	-
Aster foliaceus	-	-	-	-	-	-	57.5	57.5	-	-	95	-	87.5	-	40-	-
Aster spp.	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-
Castelleja spp.	2.5	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-
Chaenactis douglasii	-	-	-	-	7.5	-	-	-	-	-	-	-	-	-	-	-
Circium spp.	-	-	27.5	-	-	-	-	-	27.5	-	2.5	-	2.5	-	-	-
Claytonia lanceolata	-	-	-	-	-	-	-	32.5	-	-	-	-	-	-	-	-
Clarkia spp.	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-
Comandra rotundifolia	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-
Crepis spp.	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-
Delphinium nuttallii	-	-	-	-	-	-	-	25	-	-	-	-	-	-	-	-
Delphinium occidentale	-	-	-	-	-	5	2.5	-	-	-	-	-	-	-	-	-
Draba spp.	25	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Epilobium angustifolium	-	-	2.5	10	-	2.5	-	-	-	-	2.5	32.5	7.5	70	-	-
Epilobium brevistylum	-	-	20	-	-	-	-	-	-	-	-	-	2.5	-	-	-
Erigeron canus	-	-	-	-	-	7.5	-	-	-	-	-	-	-	-	-	-
Erigeron eatonii	2.5	7.5	-	-	10	50	-	-	7.5	-	-	-	-	-	-	-
Erigeron peregrinus	-	-	-	-	-	-	-	-	-	-	5	-	7.5	30	-	-
Erigeron speciosus	-	10	-	-	-	-	-	-	5	-	-	-	-	-	-	-
Eriogonum umbellatum	-	-	-	-	-	-	-	15	-	-	5	-	5	-	-	-
Eriophyllum lanatum	-	-	-	-	-	-	-	-	-	-	30	-	-	-	-	-
Fragaria virginiana	-	-	5	60	-	-	2.5	65	15	-	-	-	-	-	25	-
Fragaria spp.	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-
Frasera speciosa	-	12.5	-	-	-	2.5	-	-	-	-	-	7.5	-	-	-	-
Gallium boreale	-	-	2.5	2.5	-	-	-	5	-	-	-	-	-	-	5	-
Geranium richardsonii	-	-	-	55	-	-	-	-	-	-	-	-	-	-	-	-
Geranium viscosissimum	-	22.5	-	-	-	12.5	-	65	-	25	-	-	-	-	-	-
Gilia aggregata	-	-	-	-	-	-	-	5	-	-	2.5	-	-	-	-	-
Helenium hoopesii	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-
Hieracum albiflorum	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-
Hydrophyllum capitatum	-	-	2.5	12.5	-	-	-	22.5	-	-	-	-	-	-	-	-
Lactuca spp.	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ligusticum filicinum	-	-	-	5	-	-	-	-	-	-	2.5	2.5	-	2.5	-	-
Lithophragma parviflora	-	-	-	-	-	-	-	35	-	-	-	-	-	-	-	-
Lomatium nuttallii	-	-	-	-	-	12.5	-	-	-	-	-	-	-	-	-	-
Mertensia oblongifolia	-	-	-	-	-	-	-	15	-	-	-	-	-	-	-	-
Mertensia spp.	-	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Microseris spp.	-	-	-	-	-	-	-	12.5	-	-	-	-	-	-	-	-

TABLE 15 (cont.):

	Site 9		Site 36		Site 6		Site 80		Site 23		Site 56		Site 55		Site 70	
	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site
B. INDIVIDUAL PLANT SPECIES - Cont.																
3. Perennial Forbs - Cont.																
Orogenia linearifolia	-	-	-	-	-	-	2.5	30	-	-	-	-	-	-	-	-
Osmorhiza chilensis	-	-	-	7.5	-	5	-	-	-	2.5	-	5	-	27.5	-	-
Pedicularis bracteosus	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-
Perideridia gairdneri	-	-	-	-	-	-	-	32.5	2.5	-	-	-	-	-	-	-
Phacelia sericeus	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phlox longifolia	-	15	-	-	-	12.5	-	42.5	-	-	-	-	-	-	-	-
Potentilla diversifolia	-	2.5	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-
Potentilla glandulosa	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-
Potentilla gracilis	-	17.5	-	2.5	-	-	5	65	2.5	-	-	-	2.5	-	-	-
Pyrola elliptica	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-
Pyrola secunda	-	-	-	5	-	-	-	-	-	40	-	5	-	2.5	-	-
Ranunculus jovis	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ranunculus sardous	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-
Ranunculus spp.	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-
Rumex paucifolius	-	-	-	-	-	-	-	27.5	-	-	-	-	-	-	-	-
Rumex salicifolius	-	-	-	-	37.5	-	-	-	-	-	-	-	-	-	-	-
Sedum stenopetalum	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-
Senecio crassulus	-	-	-	-	-	15	-	-	-	-	17.5	-	-	-	-	-
Senecio dimorphophyllus	-	2.5	-	-	-	-	-	7.5	-	-	2.5	-	-	-	-	-
Senecio integerrimus	-	55	2.5	-	-	-	-	22.5	-	-	-	-	7.5	-	-	-
Senecio serra	-	-	-	15	-	-	-	2.5	-	-	-	-	-	-	-	-
Senecio spp.	-	-	-	10	-	-	-	-	-	-	-	-	-	-	-	-
Silene spp.	-	7.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sisyrinchium angustifolium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-
Smilacina spp.	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-
Solidago canadensis	-	-	-	-	-	-	-	-	52.5	-	-	-	-	-	-	-
Solidago multiradiata	-	-	-	-	-	-	-	-	-	-	5	-	7.5	-	-	-
Stellaria jamesiana	-	-	2.5	25	-	-	-	-	-	-	-	-	-	-	-	-
Tanacetum nuttallii	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-
Taraxacum officinale	-	17.5	7.5	7.5	37.5	22.5	40	62.5	92.5	-	70	-	77.5	-	100	-
Thalictrum occidentale	-	-	-	60	-	-	-	7.5	-	2.5	-	15	-	5	-	-
Townsendia alpigena	-	-	-	-	-	7.5	-	-	-	-	-	-	-	-	-	-
Tragopogon dubius	-	-	-	-	-	-	7.5	2.5	15	-	-	-	-	-	-	-
Valeriana occidentalis	-	-	-	-	-	-	-	17.5	-	-	-	-	-	-	-	-
Viola adunca	-	-	-	20	-	-	-	12.5	-	-	-	-	-	-	-	-
Viola nuttallii	-	40	-	27.5	-	47.5	-	70	-	-	-	-	-	-	-	-
Viola spp.	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wyethia amplexicaulis	-	-	-	-	-	-	-	65	-	-	-	-	-	-	-	-
Unknown Perennial	-	5	-	-	-	-	-	-	-	-	-	7.5	-	-	-	-
Perennial #1	-	-	-	-	-	-	-	7.5	-	-	-	-	-	-	-	-

TABLE 15 (cont.):

	Site 9		Site 36		Site 6		Site 80		Site 23		Site 56		Site 55		Site 70	
	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site*
B. INDIVIDUAL PLANT SPECIES - Cont.																
3. Perennial Forbs - Cont.																
Perennial #9	-	-	-	2.5	-	-	-	2.5	-	-	-	-	-	-	-	-
Perennial #10	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-
Perennial #19	-	-	-	20	-	-	-	-	-	-	-	-	-	-	-	-
Perennial #20	-	-	-	12.5	-	-	-	-	-	-	-	-	-	-	-	-
Perennial #21	-	-	-	30	-	-	-	-	-	-	-	-	-	-	-	-
Perennial #22	-	-	-	-	-	-	2.5	7.5	-	-	-	-	-	-	-	-
Perennial #23	-	-	-	-	-	-	-	20	-	-	-	-	-	-	-	-
Perennial #25	-	-	-	-	-	-	-	12.5	-	-	-	-	-	-	-	-
Perennial #26	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-
Perennial #27	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-
Perennial #28	-	-	-	10	-	-	-	-	-	-	-	-	-	-	-	-
Perennial #29	-	-	-	50	-	-	-	-	-	-	-	-	-	-	-	-
4. Annual Forbs																
Androsace septentrionalis	32.5	7.5	-	2.5	5	10	-	52.5	-	-	-	-	5	-	-	-
Atriplex spp.	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chenopodium spp.	-	-	12.5	-	7.5	-	-	-	-	-	-	-	-	-	-	-
Chrysopsis villosa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	-
Collinsia parviflora	5	-	57.5	-	-	-	-	62.5	5	-	-	-	-	-	-	-
Collomia linearis	2.5	-	15	30	5	-	17.5	22.5	12.5	-	12.5	-	2.5	-	52.5	-
Cruciferae spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-
Descurainia spp.	-	-	-	-	7.5	-	-	-	-	-	-	-	-	-	-	-
Draba spp.	-	-	-	-	-	-	-	17.5	-	-	-	-	-	-	-	-
Epilobium paniculatum	-	-	2.5	-	7.5	-	32.5	20	2.5	-	10	-	-	-	22.5	-
Epilobium spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-
Gallium bifolium	5	-	15	5	-	-	-	17.5	-	-	-	-	-	-	2.5	-
Gayophytum diffusum	-	-	17.5	-	-	-	-	-	-	-	-	-	-	-	-	-
Linanthus harknessii	-	-	-	-	-	2.5	20	7.5	2.5	-	-	-	-	-	-	-
Matricaria maritima	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.5	-
Monolepsis nuttalliana	22.5	-	-	-	30	-	-	-	-	-	-	-	-	-	-	-
Nemophila breviflora	-	-	-	-	-	-	-	60	-	-	-	-	-	-	-	-
Polygonum arviculare	-	-	-	-	17.5	-	-	-	-	-	-	-	-	-	-	-
Polygonum confertifolium	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-
Polygonum douglasii	30	-	60	-	30	-	-	10	10	-	45	-	7.5	-	-	-
Polygonum sawatchense	22.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE 15 (cont.):

	Site 9		Site 36		Site 6		Site 80		Site 23		Site 56		Site 55		Site 70	
	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site
B. INDIVIDUAL PLANT SPECIES - Cont.																
4. Annual Forbs - Cont.																
Veronica biloba	-	-	-	-	-	-	45	-	-	-	-	-	-	-	-	-
Annual #3	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-
Annual #6	-	-	-	-	17.5	-	-	-	-	-	-	-	-	-	-	-
Annual #10	-	-	-	-	-	-	92.5	-	-	-	-	-	-	-	7.5	-
Annual #12	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-
Annual #15	-	-	-	-	-	-	-	10	-	-	-	-	-	-	-	-
Annual #25	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-
Annual #26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	47.5	-
5. Leguminous Forbs																
Astragalus miser	5	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Astragalus spp.	-	-	-	-	-	72.5	-	5	-	-	-	-	-	-	7.5	-
Lupinus argenteus	-	45	-	-	-	27.5	-	-	-	-	12.5	37.5	12.5	22.5	-	-
Lupinus caudatus	-	-	-	-	-	-	-	7.5	-	-	-	-	-	-	-	-
Lupinus sericeus	-	-	-	-	-	-	-	10	-	-	-	-	-	-	-	-
Lupinus wyethia	-	-	7.5	55	-	-	-	-	-	-	-	-	-	-	-	-
Trifolium gymnocarpon	-	-	-	-	-	-	2.5	55	-	-	-	-	-	-	-	-
Trifolium longipes	-	-	-	-	-	-	-	32.5	-	-	-	-	-	-	-	-
Trifolium pratense	-	-	17.5	-	-	-	-	-	32.5	-	42.5	-	65	-	75	-
Trifolium spp. #1	-	-	-	-	-	-	80	-	-	-	-	-	-	-	-	-
Trifolium spp. #2	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-
Trifolium spp.	-	-	-	-	7.5	-	-	-	-	-	-	-	10	-	12.5	-
6. Shrub and Tree Seedlings																
Abies lasiocarpa	2.5	45	-	20	-	35	-	10	5	80	2.5	50	10	55	-	-
Amelanchier alnifolia	-	-	-	7.5	-	-	-	5	-	2.5	-	-	-	-	-	-
Artemisia cana	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-
Artemisia tridentata var. vaseyana	2.5	-	-	-	-	5	-	15	2.5	-	-	-	-	-	-	-
Berberis repens	-	-	-	-	-	-	-	7.5	-	-	-	-	-	-	-	-

TABLE 15 (cont.):

	Site 9		Site 36		Site 6		Site 80		Site 23		Site 56		Site 55		Site 70	
	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site	Dist. Site	Nat. Site*
B. INDIVIDUAL PLANT SPECIES - Cont.																
6. Shrub and Tree Seedlings - Cont.																
Lonicera utahensis	-	-	-	15	-	-	-	-	-	-	-	-	-	5	-	-
Pachistima myrsinites	-	-	-	32.5	-	-	-	5	-	37.5	-	-	-	-	-	-
Picea englemannl	-	-	-	-	-	-	-	-	-	-	2.5	5	2.5	-	-	-
Pinus albicaulis	-	-	-	-	-	-	-	-	-	-	-	7.5	-	15	-	-
Pinus contorta	-	-	-	-	-	-	-	-	17.5	-	15	-	-	-	2.5	-
Pseudostuga menziesii	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-
Ribes montigenum	-	-	-	-	-	7.5	-	-	-	-	-	5	-	2.5	-	-
Ribes viscosissimum	-	-	10	10	-	-	-	-	2.5	2.5	-	-	-	-	-	-
Rosa woodsii	-	-	-	20	-	-	-	5	-	-	-	-	-	-	-	-
Salix spp.	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-
Shepherdia canadensis	-	-	-	-	-	-	-	-	-	15	-	-	-	-	-	-
Sorbus scopulina	-	-	-	7.5	-	-	-	-	-	-	-	-	-	-	-	-
Symphoricarpos albus	-	-	-	-	-	-	-	17.5	-	-	-	-	-	-	-	-
Symphoricarpos oreophilus	-	-	-	30	-	-	-	-	-	-	-	-	-	-	-	-
Vaccinium scoparium	-	-	-	-	-	-	-	5	-	-	-	95	-	37.5	-	-
C. GROUND COVER																
Bareground	100	80	97.5	17.5	100	52.5	100	82.5	100	0	100	2.5	100	5	90	-
Litter	97.5	100	100	100	87.5	100	100	100	100	100	100	100	100	100	100	-
Moss/Lichen	0	30	7.5	57.5	2.5	40	0	20	65	55	10	35	10	17.5	7.5	-
Basal Stems	100	95	100	100	100	97.5	100	100	100	92.5	100	100	100	97.5	100	-
Small Rocks (<2 cm)	100	60	95	7.5	97.5	37.5	100	40	100	0	90	0	95	0	77.5	-
Medium Rocks (2-30 cm)	100	77.5	97.5	27.5	100	45	72.5	27.5	100	0	95	0	95	2.5	72.5	-
Large Rocks (>30 cm)	2.5	0	15	2.5	-	5	0	0	0	0	0	0	0	0	0	-

1/ Independently estimated; i.e., not summed parameters.

2/ Trees <140 cm in height.

3/ Tree canopy was measured as either being present or absent directly above a cover plot.

* Native vegetation was not sampled on Site 70.

TABLE 16. Estimated mean shrub and tree seedling (< 140 cm height) density (stems/ha) by height class for all coniferous sites, 1982.

Species	Height Class[1]	Site 9		Site 36		Site 6		Site 80		Site 23		Site 56		Site 55	
		Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.
Abies lasiocarpa	1	-	850	-	-	-	400	-	100	-	8000	350[b]	2650[a]	350[b]	4850[a]
	2	-	900	-	150	-	150	-	1500	1100[b][2]	17350[a]	400[b]	11100[a]	850[b]	9350[a]
	3	-	2500	-	2050	-	2650	-	1350	1700[b]	8900[a]	100[b]	8750[a]	550[b]	4150[a]
	4	-	850	-	400	-	450	-	-	250[b]	2000[a]	-	700	200[a]	200[a]
	TOTAL	-	5100	-	2600	-	3850	-	3150	3000[b]	36250[a]	850[b]	23200[a]	1950[b]	18550[a]
Amelanchier alnifolia	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2	-	-	-	-	-	-	-	550	-	-	-	-	-	-
	3	-	-	-	100	-	-	-	850	-	100	-	-	-	-
	4	-	-	-	50	-	-	-	-	-	-	-	-	-	-
	TOTAL	-	-	-	150	-	-	-	1400	-	100	-	-	-	-
Artemisia arbuscula	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2	-	-	-	-	-	-	-	100	-	-	-	-	-	-
	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	TOTAL	-	-	-	-	-	-	-	100	-	-	-	-	-	-
Artemisia cana	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3	-	-	-	-	-	-	-	100	-	-	-	-	-	-
	3	-	-	-	-	-	-	-	50	-	-	-	-	-	-
	TOTAL	-	-	-	-	-	-	-	150	-	-	-	-	-	-
Artemisia tridentata var. vaseyana	1	-	-	-	-	-	-	-	50	-	-	-	-	-	-
	2	-	-	-	-	50	-	50[a]	700[a]	200	-	50	-	-	-
	3	-	50	-	-	-	250	100[b]	1550[a]	50	-	50	-	-	-
	4	-	-	-	-	-	-	-	200	-	-	-	-	-	-
	TOTAL	-	50	-	-	50[a]	250[a]	150[b]	2500[a]	250	-	100	-	-	-
Berberis repens	1	-	-	-	-	-	-	-	300	-	-	-	-	-	-
	2	-	-	-	200	-	-	-	1000	-	-	-	-	-	-
	3	-	-	-	100	-	-	-	-	-	-	-	-	-	-
	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	TOTAL	-	-	-	300	-	-	-	1300	-	-	-	-	-	-

TABLE 16 (cont.):

Species	Height Class[1/]	Site 9 Dist.	Site 9 Nat.	Site 36 Dist.	Site 36 Nat.	Site 6 Dist.	Site 6 Nat.	Site 80 Dist.	Site 80 Nat.	Site 23 Dist.	Site 23 Nat.	Site 56 Dist.	Site 56 Nat.	Site 55 Dist.	Site 55 Nat.
Lonicera involucrata	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3	-	-	-	-	-	-	-	400	-	-	-	-	-	-
	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	TOTAL	-	-	-	-	-	-	-	400	-	-	-	-	-	-
Lonicera utahensis	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2	-	-	-	200	-	-	-	-	-	-	-	-	-	50
	3	-	-	-	2200	-	-	-	-	-	-	-	-	-	250
	4	-	-	-	300	-	-	-	-	-	100	-	-	-	-
	TOTAL	-	-	-	2700	-	-	-	-	-	100	-	-	-	300
Pachistima myrsinites	1	-	-	-	450	-	-	-	800	-	7650	-	-	-	-
	2	-	-	-	3000	-	-	-	850	250[b]	13250[a]	-	-	-	-
	3	-	-	-	1250	-	-	-	-	50[b]	1350[a]	-	-	-	-
	4	-	-	-	-	-	-	-	-	-	50	-	-	-	-
	TOTAL	-	-	-	4700	-	-	-	1650	300[b]	22300[a]	-	-	-	-
Picea englemanni	1	-	-	-	-	-	-	-	-	-	-	-	-	50[a]	50[a]
	2	-	50	-	-	-	-	-	-	-	-	150[a]	200[a]	-	-
	3	-	50	-	-	-	-	-	-	-	-	100[a]	150[a]	-	50
	4	-	-	-	-	-	-	-	-	-	-	-	100	100[a]	50[a]
	TOTAL	-	100	-	-	-	-	-	-	-	-	250[a]	450[a]	150[a]	150[a]
Pinus albicaulis	1	-	-	-	-	-	-	-	-	-	-	-	200	-	250
	2	-	50	-	-	-	-	-	-	-	-	-	4200	-	2050
	3	-	50	-	-	-	-	-	-	-	-	50[b]	900[a]	50[b]	1800[a]
	4	-	-	-	-	-	-	-	-	-	-	-	-	-	100
	TOTAL	-	100	-	-	-	-	-	-	-	-	50[b]	5300[a]	50[b]	4200[a]
Pinus contorta	1	-	-	-	-	-	-	-	-	-	-	50	-	-	-
	2	-	-	-	-	-	-	-	-	-	-	50	-	-	-
	3	-	-	-	-	-	-	-	-	-	-	450	-	50	-
	4	-	-	-	-	-	-	-	-	-	-	250	-	200	-
	TOTAL	-	-	-	-	-	-	-	-	-	-	800	-	250	-

TABLE 16 (cont.):

Species	Height Class[1/]	Site 9 Dist.	Site 9 Nat.	Site 36 Dist.	Site 36 Nat.	Site 6 Dist.	Site 6 Nat.	Site 80 Dist.	Site 80 Nat.	Site 23 Dist.	Site 23 Nat.	Site 56 Dist.	Site 56 Nat.	Site 55 Dist.	Site 55 Nat.
Populus tremuloides	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3	-	-	-	400	-	-	-	-	-	-	-	-	-	-
	4	-	-	-	250	-	-	-	-	-	-	-	-	-	-
	TOTAL	-	-	-	650	-	-	-	-	-	-	-	-	-	-
Potentilla fruticosa	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3	-	-	-	-	-	-	-	-	50	-	-	-	-	-
	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	TOTAL	-	-	-	-	-	-	-	-	50	-	-	-	-	-
Ribes montigenum	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2	-	150	-	-	-	100	-	-	-	-	-	100	-	-
	3	-	150	-	-	50[a]	700[a]	-	-	-	-	-	-	-	100
	4	-	-	-	-	-	50	-	-	-	-	-	-	-	-
	TOTAL	-	300	-	-	50[a]	850[a]	-	-	-	-	-	100	-	100
Ribes viscosissimum	1	-	-	450[a]	150[a]	-	-	-	-	-	-	-	-	-	-
	2	-	-	1250[a]	200[a]	-	-	-	-	250	-	-	-	-	-
	3	-	-	50[a]	1750[a]	-	-	-	-	300[a]	50[a]	-	-	-	-
	4	-	-	-	50	-	-	-	-	-	-	-	-	-	-
	TOTAL	-	-	1750[b]	2150[a]	-	-	-	-	550[a]	50[a]	-	-	-	-
Rosa woodsii	1	-	-	-	100	-	-	-	-	-	-	-	-	-	-
	2	-	-	-	250	-	-	-	450	-	-	-	-	-	-
	3	-	-	50[b]	1650[a]	-	-	-	450	-	-	-	-	-	-
	4	-	-	-	250	-	-	-	-	-	-	-	-	-	-
	TOTAL	-	-	50[b]	2250[a]	-	-	-	900	-	-	-	-	-	-
Salix spp.	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3	-	-	-	-	-	-	-	-	-	-	-	-	100	-
	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	TOTAL	-	-	-	-	-	-	-	-	-	-	-	-	100	-

Table 16 (cont.)

Species	Height Class[1]	Site 9		Site 36		Site 6		Site 80		Site 23		Site 56		Site 55	
		Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.
Shepherdia canadensis	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2	-	-	-	-	-	-	-	-	-	150	-	-	-	-
	3	-	-	-	-	-	-	-	-	-	1700	-	-	-	-
	4	-	-	-	-	-	-	-	-	-	900	-	-	-	-
	TOTAL	-	-	-	-	-	-	-	-	-	2750	-	-	-	-
Sorbus scopulina	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3	-	-	-	250	-	-	-	-	-	-	-	-	-	-
	4	-	-	-	50	-	-	-	-	-	-	-	-	-	-
	TOTAL	-	-	-	300	-	-	-	-	-	-	-	-	-	-
Symphoricarpos spp.	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2	-	-	-	450	-	-	-	1650	-	-	-	-	-	-
	3	-	-	-	5250	-	-	-	7850	50[a]	50[a]	-	-	-	-
	4	-	-	-	300	-	-	-	250	-	-	-	-	-	-
	TOTAL	-	-	-	6000	-	-	-	9750	50[a]	50[a]	-	-	-	-

[1] 1 = <5 cm; 2 = 5-15 cm; 3 = 16-60 cm; 4 = 61-140 cm

[2] Values between disturbed-native site pairs followed by the same letter are not significantly different at the .05 level (T-test).

TABLE 17. Tree density and basal area per hectare[1] on all native coniferous sites, 1982

Species	DBH Class Midpoint (cm)	Density (stems/ha) Site 9	Site 36*	Site 6	Site 80*	Site 23	Site 56	Site 55
Abies lasiocarpa	≤ 5.1	1173	183	556	-	2440	864	341
	10.2	576	101	299	7	447	247	136
	15.2	309	77	138	-	141	128	123
	20.3	143	42	141	-	54	47	91
	25.4	54	37	47	12	22	12	52
	30.5	12	10	30	2	27	-	20
	35.6	5	7	7	1	5	1	2
	40.6	5	7	-	-	7	-	-
	45.7	2	.2	-	-	7	-	1
	50.8	-	.2	-	-	4	-	-
	55.9	-	7	-	-	2	-	-
	61.0	-	.2	-	-	-	-	-
	66.0	-	-	-	-	-	-	-
	71.1	-	.2	-	-	-	-	-
	≥76.2	-	.2	-	-	-	-	-
	TOTAL	2279	472	1218	22	3156	1299	765
	BASAL AREA (m^2/ha)	53	5	28	.3	73	30	18
Picea englemanni	≤ 5.1	153	-	-	-	-	-	-
	10.2	42	-	22	-	-	-	-
	15.2	20	-	20	-	-	-	-
	20.3	27	-	15	-	-	-	-
	25.4	15	-	27	-	-	10	5
	30.5	1	-	2	-	-	1	-
	35.6	2	-	15	-	-	-	-
	40.6	-	-	12	-	-	-	5
	45.7	-	-	2	-	-	-	-
	50.8	-	-	7	-	-	-	1
	55.9	25	-	-	-	-	-	.7
	61.0	-	-	2	-	-	-	-
	66.0	-	-	.7	-	-	-	-
	71.1	-	-	-	-	-	-	-
	≥76.2	-	-	-	-	-	-	-
	TOTAL	285	-	125	-	-	11	12
	BASAL AREA (m^2/ha)	6.6	-	3	-	-	.2	.3
Pinus albicaulis	≤ 5.1	94	-	-	-	-	-	-
	10.2	72	-	35	-	-	64	44
	15.2	138	-	99	-	-	190	32
	20.3	64	-	146	-	-	264	109
	25.4	72	-	67	-	-	227	126
	30.5	22	-	25	-	-	121	52
	35.6	10	-	2	-	-	47	40
	40.6	1	-	-	-	-	12	44
	45.7	1	-	-	-	-	-	17
	50.8	-	-	-	-	-	-	-
	55.9	2	-	-	-	-	-	2
	61.0	.5	-	-	-	-	-	-
	66.0	-	-	-	-	-	-	-
	71.1	-	-	-	-	-	-	-
	≥76.2	-	-	-	-	-	-	-
	TOTAL	476	-	374	-	-	915	466
	BASAL AREA (m^2/ha)	11	-	8.7	-	-	21	10.8

TABLE 17 (cont.):

Species	DBH Class Midpoint (cm)	Density (stems/ha) Site 9	Site 36*	Site 6	Site 80*	Site 23	Site 56	Site 55
Pinus contorta	≤ 5.1	-	-	-	99	926	121	-
	10.2	-	-	-	57	640	-	-
	15.2	-	-	-	35	274	-	7
	20.3	-	-	-	27	59	2	-
	25.4	-	-	-	35	30	30	2
	30.5	10	.5	-	17	1	27	10
	35.6	-	.2	-	20	5	20	17
	40.6	-	.5	-	2	-	12	12
	45.7	-	.7	-	.7	-	10	15
	50.8	-	1	-	2	-	2	5
	55.9	-	.5	-	-	-	-	-
	61.0	-	-	-	2	-	-	-
	66.0	-	-	-	-	-	-	-
	71.1	-	-	-	-	-	-	-
	≥76.2	-	-	-	-	-	-	-
	TOTAL	10	3	-	297	1925	222	68
	BASAL AREA (m^2/ha)	.2	.03	-	3.5	15	7.8	7.4
Populus tremuloides	≤ 5.1	-	-	-	-	-	-	-
	10.2	-	-	-	-	-	-	-
	15.2	-	-	-	-	-	-	-
	20.3	-	-	-	-	-	-	-
	25.4	-	-	-	-	-	-	-
	30.5	-	-	-	-	-	-	-
	35.6	-	2	-	-	-	-	-
	40.6	-	-	-	-	-	-	-
	45.7	-	-	-	-	-	-	-
	50.8	-	-	-	-	-	-	-
	55.9	-	-	-	-	-	-	-
	61.0	-	-	-	-	-	-	-
	66.0	-	-	-	-	-	-	-
	71.1	-	-	-	-	-	-	-
	≥76.2	-	-	-	-	-	-	-
	TOTAL	-	2	-	-	-	-	-
	BASAL AREA (m^2/ha)	-	.02	-	-	-	-	-
Pseudotsuga menziesii	≤ 5.1	-	-	-	-	-	-	-
	10.2	-	-	-	-	-	-	-
	15.2	-	-	-	-	-	-	-
	20.3	-	.1	-	-	-	-	-
	25.4	-	.5	-	-	-	-	-
	30.5	-	.5	-	-	-	-	-
	35.6	-	1.5	-	-	-	-	-
	40.6	-	1	-	-	-	-	-
	45.7	-	.2	-	-	-	-	-
	50.8	-	.5	-	-	-	-	-
	55.9	-	.2	-	-	-	-	-
	61.0	-	-	-	-	-	-	-
	66.0	-	-	-	-	-	-	-
	71.1	-	1	-	-	-	-	-
	≥76.2	-	1	-	-	-	-	-
	TOTAL	-	7	-	-	-	-	-
	BASAL AREA (m^2/ha)	-	.08	-	-	-	-	-

1/ Of Stems >140 cm in height.

* BAF of 5 used in plotless sampling, all others are BAF of 10.

TABLE 18. Plant community descriptors[1] for all coniferous sites, 1982.

Site	Spatz Similarity Index (%)	Shannon-Weiner Diversity Index		Richness (Total Number of Species)		Number of Species Common To Both Sites
		Dist.	Nat.	Dist.	Nat.	
9	3.2	1.08	1.25	35	34	12
36	2.4	.78	1.0	31	50	15
6	.65	.60	1.26	21	37	7
80	1.7	.89	1.62	23	80	13
23	.60	1.08	.61	31	11	3
56	.80	1.04	.61	35	17	6
55	1.9	.99	.51	41	18	8

TABLE 19. Total number of droppings counted per site on all coniferous sites, 1982.

Species	Site 9		Site 36		Site 6		Site 80		Site 23		Site 56		Site 55	
	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.
Cattle	0	9	-	-	22[a]	5[a]	-	-	12[a]	1[a]	3	0	5	0
Buffalo	-	-	-	-	-	-	23[a]	8[b]	-	-	-	-	-	-
Horses	-	-	-	-	-	-	17	0	-	-	-	-	3	0
Deer	0	9	6[a]1/	4[a]	0	5	0	1	3[a]	8[a]	0	3	0	2
Elk	0	5	8[a]	15[a]	0	5	3	0	0	13	0	4	0	15
Antelope	-	-	-	-	-	-	2[a]	3[a]	-	-	-	-	-	-
Moose	0	2	0	3	0	2	-	-	-	-	0	15	2	0

1/ Values between disturbed-native site pairs followed by the same letter are not significantly different at the .05 level (T-test).

TABLE 20. Results of laboratory analysis of soil samples from all coniferous sites, 1982.

Parameter	Depth[1/]	Site 9		Site 36		Site 6		Site 80		Site 23		Site 56		Site 55		Site 70	
		Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.
Textural Class[2/]	1	L	L	CL	CL	L	SL	C	C	L	L	SL	SL	CL	SL	CL	L
	2	L	L	L	CL	L	SL	C	C	L	L	SL	SL	CL	SL	C	CL
	3	L	L	CL	CL	L	SL	C	C	L	L	SL	SL	CL	SL	C	C
	4	SCL	L	L	CL	CL	CL	C	C	L	L	SL	SL	L	SL	C	CL
	5	SCL	L	CL	CL	CL	L	C	C	L	L	SL	SL	CL	SL	C	C
Sand (%)	1	43	44	31	35	30	24	25	29	40	41	64	59	30	56	29	38
	2	46	40	28	35	27	21	25	27	40	36	59	57	30	55	22	32
	3	45	39	30	35	29	20	25	21	41	38	59	58	32	55	25	31
	4	49	42	28	36	25	22	25	18	43	39	58	61	40	56	30	30
	5	48	47	29	39	25	38	25	16	44	40	59	63	32	57	18	30
Silt (%)	1	34	40	36	38	48	53	29	28	37	46	21	26	40	25	32	40
	2	28	41	50	38	47	54	29	28	37	45	21	28	42	29	30	34
	3	30	40	31	37	48	55	30	28	35	43	21	27	41	28	31	29
	4	23	37	29	36	47	47	32	22	36	44	21	24	36	27	28	31
	5	24	32	31	33	48	47	31	21	36	40	21	22	38	27	32	30
Clay (%)	1	23	16	33	27	22	23	46	43	23	13	15	15	30	19	39	22
	2	26	19	22	27	26	25	46	45	23	19	20	15	28	16	48	34
	3	25	21	39	28	23	25	45	51	24	19	20	15	27	17	44	40
	4	28	21	43	28	28	31	43	60	21	17	21	15	24	17	42	39
	5	28	21	40	28	27	15	44	63	20	20	20	15	30	16	50	40
Total Coarse Fragments (%)	1	50	30	5	7	30	10	3	1	20	3	15	2	20	2	3	1
	2	50	30	3	7	30	15	5	1	20	3	15	5	20	2	2	3
	3	50	30	5	7	30	15	7	1	25	7	35	5	20	2	2	4
	4	50	30	7	10	30	30	3	1	45	10	35	5	20	2	2	15
	5	50	30	3	10	30	50	3	1	45	20	25	30	20	10	4	25
Coarse Fragments <1.2 cm (%)	1	90	95	80	98	70	90	100	100	90	100	90	100	30	100	90	100
	2	90	95	90	98	70	90	100	100	90	100	90	100	30	100	98	100
	3	80	95	95	98	70	90	100	100	90	100	50	100	30	100	98	100
	4	80	95	20	98	70	50	100	100	85	100	50	100	30	100	98	70
	5	80	95	95	90	70	20	100	100	85	95	70	50	30	90	95	50
Coarse Fragments >1.2 cm (%)	1	10	5	20	2	30	10	0	0	10	0	10	0	70	0	5	0
	2	10	5	10	2	30	10	0	0	10	0	10	0	70	0	2	0
	3	20	5	5	2	30	10	0	0	10	0	50	0	70	0	2	0
	4	20	5	80	10	30	50	0	0	15	0	50	0	70	0	2	30
	5	20	5	5	10	30	80	0	0	15	5	30	50	70	10	5	50

TABLE 20 (cont.):

Parameter	Depth[1/]	Site 9		Site 36		Site 6		Site 80		Site 23		Site 56		Site 55		Site 70	
		Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.
Bulk Density (g/cm^3)	1	1.49	1.11	1.44	1.26	1.49	1.28	1.73	1.58	1.30	1.16	1.73	1.01	1.56	1.26	1.39	1.17
	2	1.76	1.22	1.65	1.39	1.39	1.32	2.02	1.53	1.44	1.43	1.91	1.38	1.78	1.33	1.81	1.07
	3	1.89	1.44	1.93	1.32	1.55	1.31	2.05	1.75	1.56	1.34	1.94	1.52	1.88	1.36	1.67	1.18
	4	2.15	1.27	1.52	1.48	1.29	1.36	2.01	1.95	1.57	1.49	2.05	1.41	1.96	1.58	1.77	1.27
	5	2.01	1.77	1.90	1.70	1.51	1.26	2.01	1.93	1.65	1.66	1.97	1.51	1.92	1.76	1.80	1.65
pH	1	7.3	6.3	6.9	6.0	7.2	6.7	7.6	6.2	7.2	5.5	6.2	5.5	7.4	5.3	6.4	5.0
	2	7.3	5.8	7.2	5.7	7.4	6.5	7.7	5.8	7.3	5.5	5.9	5.5	7.5	5.1	5.7	5.2
	3	7.1	5.6	7.4	5.5	7.3	6.5	7.6	5.7	7.2	5.5	5.9	5.7	7.6	5.2	5.4	5.3
	4	7.3	5.4	7.3	5.7	6.8	6.9	7.6	5.7	7.1	5.8	5.8	6.0	7.6	5.1	5.4	5.3
	5	7.3	5.2	7.4	5.4	7.0	7.4	7.7	5.7	6.9	5.9	5.9	5.8	7.0	5.3	6.5	5.3
Available Phosphorus (ppm)	1	14	20	33	31	29	10	24	25	34	22	14	16	10	13	18	24
	2	12	15	28	38	18	6	10	24	37	28	9	19	9	17	12	26
	3	13	20	16	56	21	6	9	19	37	48	10	24	9	18	15	39
	4	10	22	22	63	11	6	11	8	38	35	11	19	10	19	16	28
	5	8	19	18	44	10	6	9	9	37	33	10	11	11	22	12	41
Potassium (meq/100g)	1	.53	.78	.59	.68	1.09	.87	.56	.86	.88	.65	.41	.61	.47	.19	.59	1.14
	2	.48	.52	.60	.55	.96	.61	.49	.68	.71	.49	.30	.47	.41	.51	.50	1.06
	3	.52	.34	.51	.36	.65	.40	.50	.61	.30	.39	.25	.42	.39	.32	.40	1.02
	4	.42	.27	.58	.37	.36	.32	.50	.56	.23	.28	.27	.29	.34	.25	.33	.75
	5	.38	.22	.49	.32	.44	.21	.50	.58	.29	.28	.26	.29	.46	.22	.35	.91
Organic Matter (%)	1	5.8	13.7	5.1	5.6	5.2	5.0	1.8	11.0	5.0	12.3	.8	5.4	.8	.6	3.9	6.0
	2	3.7	6.1	2.4	4.7	4.8	4.4	2.0	8.2	5.0	4.4	.8	2.4	.7	9.8	2.9	10.5
	3	5.9	3.6	.8	2.6	9.1	3.6	1.8	4.0	2.2	2.1	.9	1.4	.6	2.4	2.7	4.1
	4	2.5	3.2	.8	1.6	4.1	3.2	1.8	2.0	1.6	1.1	.6	.6	.5	1.8	1.9	3.1
	5	2.1	1.4	1.3	1.0	3.8	3.6	1.9	1.4	1.8	.8	.6	.8	.6	1.1	2.2	3.4
Cation Exchange Capacity (meq/100g)	1	20.7	24.9	24.7	18.6	29.0	29.1	25.0	29.4	19.3	22.4	24.7	37.7	46.1	24.5	25.8	41.7
	2	18.1	22.1	27.3	17.6	30.0	29.4	25.8	27.4	18.7	18.1	31.4	14.1	46.6	35.0	27.5	41.3
	3	21.4	18.5	27.0	15.6	32.9	30.6	25.7	24.1	12.5	12.3	31.8	12.5	46.0	27.1	27.6	38.0
	4	15.1	16.6	26.8	14.6	28.1	30.0	25.8	30.1	10.6	8.8	33.5	11.0	41.7	27.6	25.3	36.0
	5	14.2	13.0	26.4	13.7	28.8	21.9	25.8	38.4	10.4	9.1	33.4	12.7	47.4	26.1	32.1	37.8
Sodium (meq/100g)	1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
	2	<.1	<.1	<.1	<.1	<.1	<.1	.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
	3	<.1	<.1	<.1	<.1	<.1	<.1	.2	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
	4	.1	<.1	<.1	<.1	.1	<.1	.4	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	.1
	5	.1	<.1	<.1	<.1	.1	<.1	1.33	.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1

TABLE 20 (cont.):

Parameter	Depth[1/]	Site 9		Site 36		Site 6		Site 80		Site 23		Site 56		Site 55		Site 70	
		Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.	Dist.	Nat.
Calcium (meq/100g)	1	13.2	10.1	21.4	6.0	28.6	15.5	22.9	15.1	21.2	9.0	4.9	6.4	21.0	4.3	13.5	21.6
	2	19.1	5.8	34.5	5.8	30.3	24.5	26.4	13.4	22.1	5.9	6.8	3.5	21.8	7.0	13.2	19.4
	3	13.6	4.4	38.3	4.9	29.8	17.5	25.6	11.2	11.9	4.1	6.8	3.3	21.8	3.7	13.0	17.0
	4	12.7	3.3	36.0	4.8	19.3	20.2	23.9	13.6	7.3	3.7	7.3	2.9	20.4	2.8	12.0	15.8
	5	10.9	2.8	37.8	5.3	23.0	21.4	25.6	17.4	6.2	4.1	7.2	3.6	16.9	3.0	19.6	16.7
Magnesium (meq/100g)	1	2.2	.7	.6	.4	.9	1.7	2.2	2.2	.4	.5	.8	.8	2.0	.8	1.5	1.3
	2	1.9	.4	.7	.3	.7	2.0	2.6	2.0	.3	.3	1.0	.5	2.0	.7	1.7	1.5
	3	2.1	.3	.9	.2	.7	2.0	2.8	2.1	<.1	<.1	1.0	.5	2.2	.5	1.7	1.9
	4	1.6	.2	1.0	.3	.9	3.1	2.8	3.6	<.1	<.1	1.2	.5	2.1	.5	1.6	2.0
	5	1.4	.2	.8	.5	1.0	2.2	3.1	4.7	.3	.4	1.1	.6	2.6	.5	2.0	2.1
Sodium Absorption Ratio	1	.5	.3	.4	.4	.7	.7	4.9	.3	.2	1.2	1.1	.6	.5	1.2	1.2	.2
	2	.8	.5	.8	.4	.4	.4	1.2	.5	.4	.5	1.0	.6	.6	.6	1.0	.2
	3	.5	.7	.7	.9	.6	1.1	1.1	.6	.6	.8	.9	.9	.7	1.1	1.8	.7
	4	.5	.5	.7	.5	.6	.4	1.4	1.1	.7	.9	1.2	1.1	.7	.9	1.9	.4
	5	.4	.9	.6	1.0	.8	.2	2.4	.4	.4	1.4	.6	1.1	1.2	1.7	.8	.7
Electrical Conductivity (millimhos)	1	.4	.3	.6	.3	.7	.5	.5	.4	.7	.4	.5	.5	.4	.2	.3	.3
	2	.4	.3	.5	.4	.5	.4	.5	.4	.6	.4	.3	.4	.4	.5	.3	.3
	3	.5	.5	.5	.3	.5	.4	.5	.2	.4	.2	.3	.2	.4	.4	.4	.3
	4	.2	.1	.4	.3	.3	.4	.5	.4	.2	.3	.3	.3	.3	.3	.4	.4
	5	.4	.4	.5	.4	.3	.5	.6	.4	.4	.4	.3	.3	.4	.3	.4	.3

[1/] 1 = 0-5 cm; 2 = 6-10 cm; 3 = 11-20 cm; 4 = 21-30 cm; 5 = 31-50 cm

[2/] C = Clay; CL = Clay Loam; L = Loam; SL = Sandy Loam; SCL = Sandy Clay Loam

APPENDIX E

SIGNIFICANT LINEAR EQUATIONS

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TABLE 21. Significant linear equations resulting from analysis of disturbed site vegetation/soils parameters against age since abandonment.

Parameters (Y) Tested Against Age Since Abandonment (X)	Equation	R^2 Value	Significance (α)
SAGEBRUSH SITES			
Percent Organic Matter* (0-5 cm layer)	Y = .0729 + .0346X	25.5	.20
Available Phosphorus* (0-5 cm layer)	Y = .457 + .0292X	33.2	.20
Perennial Grass Canopy Cover* (seeded sites only)	Y = 1.71 - .0629X	70.7	.10
Perennial Forb Canopy Cover* (seeded sites only)	Y = -.113 + .0473X	67.1	.10
Shrub Canopy Cover* (all sites)	Y = -.0043 + .0129X	30.9	.20
(seeded sites only)	Y = -.137 + .0326X	71.6	.10
Spatz Similarity Index (all sites)	Y = 1.93 + .225X	37.7	.20
(seeded sites)	Y = .358 + .439X	64.0	.20
CONIFEROUS SITES			
Exchangeable Potassium* (6-30 cm layer)	Y = 1.39 - .0228X	53.2	.20
Perennial Grass Canopy Cover* (seeded sites only)	Y = 8.18 - 4.0X	73.0	.10
Perennial Forb Canopy Cover* (all sites)	Y = -.136 + .0481X	49.5	.10
(seeded sites only)	Y = -.465 + .0956X	79.1	.05
Shrub/Tree Seedling Canopy Cover (all sites)	Y = -.0143 + .0045X	36.1	.20
(seeded sites only)	Y = -.0496 + .0098X	67.0	.10
Spatz Similarity Index (seeded sites only)	Y = 2.87 - .117X	60.6	.20
Diversity Index* (all sites)	Y = .365 + .0558X	74.4	.05
Species Richness* (all sites)	Y = .225 + .0821X	64.1	.05

* Denotes a disturbed/native site value ratio.

TABLE 12. Significant linear equations resulting from analysis between disturbed site soil parameters.

Tested Parameters	Equation	R^2 Value	Significance (α)
Bulk Density (X) vs. Percent Organic Matter (Y)	Y = 16.9 - 8.28X	43.2	.01
Percent Organic Matter (X) vs. Available Phosphorus (Y)	Y = 9.28 + 3.21X	44.3	.01

APPENDIX F
SPECIES RICHNESS AND COMMON SPECIES

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TABLE 23. Sagebrush sites: species richness and number of species common to each disturbed and native subsite by plant class.

	58D[1/]	(+)[2/]	58N	30D	(+)	30N	29D	(+)	29N	46D	(+)	46N
Perennial Grasses & Grasslikes	10	3	13	9	5	10	13	8	17	16	7	13
Perennial Forbs	10	6	32	7	4	13	6	5	29	15	9	23
Annual Forbs	8	2	8	2	0	0	4	1	4	11	2	3
Leguminous Forbs	4	1	5	2	1	2	1	0	2	3	2	2
Shrubs	1	1	4	1	1	1	0	0	2	3	2	2
TOTAL	33	13	62	21	11	26	24	14	54	48	22	43

	73D	(+)	73N	76D	(+)	76N	88D	(+)	88N	33D	(+)	33N
Perennial Grasses & Grasslikes	5	2	9	7	2	11	7	3	9	11	5	10
Perennial Forbs	15	8	16	5	3	17	8	3	14	19	12	33
Annual Forbs	5	2	2	2	2	10	0	0	2	8	6	8
Leguminous Forbs	1	1	1	1	1	3	2	1	2	2	1	3
Shrubs	2	1	2	2	2	4	3	2	6	4	3	3
TOTAL	28	14	30	17	10	45	20	9	33	44	27	57

1/ D = Disturbed subsite; N = Native subsite
2/ (+) = common species

TABLE 24. Coniferous sites: species richness and number of species common to each disturbed and native subsite by plant class.

	9D[1]	(+)[2]	9N	36D	(+)	36N	6D	(+)	6N	80D	(+)	80N
Perennial Grasses & Grasslikes	15	4	6	6	3	9	5	2	8	4	1	12
Perennial Forbs	8	4	23	13	8	28	6	4	22	10	8	44
Annual Forbs	9	2	2	9	2	2	9	1	2	6	3	10
Leguminous Forbs	1	1	2	2	1	1	1	0	2	3	1	5
Shrubs	1	0	0	1	1	7	0	0	2	0	0	8
Tree Seedlings (140 cm)	1	1	1	0	0	2	0	0	1	0	0	1
TOTAL	35	12	34	31	15	49	21	7	37	23	13	80

	23D	(+)	23N	56D	(+)	56N	55D	(+)	56N
Perennial Grasses & Grasslikes	5	0	0	7	0	1	13	1	3
Perennial Forbs	16	1	7	20	3	10	19	5	9
Annual Forbs	5	0	0	4	0	0	3	0	0
Leguminous Forbs	1	0	0	2	1	1	3	1	1
Shrubs	2	1	3	0	0	2	1	0	3
Tree Seedlings (140 cm)	2	1	1	3	2	3	2	1	2
TOTAL	31	3	11	36	6	17	41	8	18

[1] D = Disturbed subsite; N = Native subsite

[2] (+) = Common species

APPENDIX G

SPECIES OCCURRENCE ON DISTURBED SITES RELATIVE TO SITE CHARACTERISTICS

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TABLE 25. Sagebrush sites: occurence of species on disturbed sites according to soil type, elevation and annual precipitation.

	SOILS						ELEVATION				ANNUAL PRECIPITATION			
	(1 Site) Clay		(3 Sites) Loam		(4 Sites) Sand		(4 Sites) < 2400 m		(4 Sites) > 2400 m		(4 Sites) < 65 cm		(4 Sites) > 65 cm	
	Mean Cover (%)[1]	Freq. (%)[2]	Mean Cover (%)	Freq. (%)	Mean Cover (%)	Freq. (%)	Mean Cover (%)	Freq. (%)	Mean Cover (%)	Freq. (%)	Mean Cover (%)	Freq. (%)	Mean Cover (%)	Freq. (%)
PERENNIAL GRASSES														
*Agropyron intermedium			.4	67	2.0	25	.1	25	1.5	50	.6	50	2.0	25
Agropyron trachycaulum					4.0	75			4.0	75	1.2	25	5.4	50
*Bromus inermis	.1	100	8.4	100	6.2	100	6.6	100	6.0	100	7.2	100	5.4	100
Bromus marginatus			.6	67	.1	25	.6	50	.1	25	.6	50	.1	25
*Dactylis glomerata			11.6	33	10.6	25	11.6	25	10.6	25	11.6	25	10.6	25
Deschampsia caespitosa					6.0	50			6.0	50			6.0	50
*Festuca arundinacea			2.8	33			2.8	25			2.8	25		
Festuca idahoensis	.8	100			3.2	25	.8	25	3.2	25	3.2	25	.8	25
Hesperochloa kingii			1.6	33	.2	25			.9	50	1.6	25	.2	25
Hordeum brachyantherum					2.4	50			2.4	50			2.4	50
Koeleria cristata			.1	33	1.0	25	1.0	25	.1	25	.1	25	1.0	25
*Phleum pratense					2.2	75			2.2	75	.1	25	3.2	50
Poa canbyi			.2	33	.9	50	.2	25	.9	50	.2	25	.9	50
Poa palustris			.2	33	.6	50			.5	75	.4	50	.7	25
*Poa pratensis	2.0	100	3.0	100	1.2	25	3.2	75	1.3	50	3.0	75	1.6	50
GRASSLIKES														
Carex microptera	.1	100			1.3	50	.1	25	1.3	50	.6	50	1.3	25
LEGUMINOUS FORBS														
Lupinus argenteus					.6	25			.6	25	.6	25		
Lupinus sericeus			1.6	33	3.4	25	2.5	50			1.6	25	3.4	25
PERENNIAL FORBS														
Achillea millefolium	.5	100	.2	67	1.1	100	.2	75	1.2	100	.6	75	.9	100
Aster chilensis	14.1	100	1.7	67	.6	50	4.6	100	.4	25	1.6	50	5.1	75
Eriogonum umbellatum			2.1	33	.3	25	.3	25	2.1	25	2.1	25	.3	25
Geranium viscosissimum			.6	67			.6	50			.6	50		
Potentilla gracilis			.1	33	2.1	50	.1	25	2.1	50	2.1	50	.1	25
Taraxacum officinale	1.4	100	.2	100	5.8	100	1.4	100	4.7	100	1.6	100		
SHRUBS														
Artemisia tridentata var. vaseyana	.7	100	3.7	100	5.4	75	5.6	100	1.9	75	3.1	100	5.2	75
Artemisia cana	.1	100			5.6	25	.1	25	5.6	25	5.6	25	.1	25
Symphoricarpos spp.			.9	67			.2	25	1.6	25	.9	50		

[1] On sites where species occurred
[2] Among all sites in category
* Introduced species

TABLE 26. Coniferous sites: occurence of species on disturbed sites according to soil type, elevation and annual precipitation.

	SOILS						ANNUAL PRECIPITATION AND ELEVATION			
	(3 Sites) Clay		(3 Sites) Loam		(1 Site) Sand		(3 Sites) < 65 cm <2500 m		(4 Sites) > 65 cm >2500 m	
	Mean Cover (%)[1]	Freq. (%)[2]	Mean Cover (%)	Freq. (%)	Mean Cover (%)	Freq. (%)	Mean Cover (%)	Freq. (%)	Mean Cover (%)	Freq. (%)
PERENNIAL GRASSES										
*Agroovron cristatum	3.8	33					3.8	33		
*Agroovron intermedium	2.2	33	1.2	33			2.2	33	1.2	25
Agroovron trachycaulum	.1	33	2.5	100			.1	67	3.7	50
*Bromus inermis	8.3	100	7	100	.5	100	11.0	100	3.4	100
*Dactylis glomerata	20.8	33	4.2	33			20.8	33	4.2	25
*Phleum pratense			1.7	67			3.4	33	.1	25
Poa canbyi	1.2	33							1.2	25
Poa curta	1.5	33			.3	100			.8	50
*Poa pratensis	1.4	67	.1	33			.4	67	2.0	25
Trisetum spicatum	1.5	33	.1	67	.2	100			1.0	100
GRASSLIKES										
Carex rossii			1.4	67	2.1	100	2.3	33	1.2	50
LEGUMINOUS FORBS										
Lupinus argenteus	.9	33			.4	100			.6	50
*Trifolium pratense	5.8	67	2.2	33	9.3	100	1.5	67	10.0	50
PERENNIAL FORBS										
Achillea millefolium	1.4	100	1.8	67	.6	100	1.6	100	1.2	75
Antennaria microphylla	.1	33	3.5	33	.4	100	3.5	33	.2	50
Antennaria racemosa	.1	33			1.0	100			.5	50
Fragaria virginiana	.2	67	1.2	33			.5	100		
Taraxacum officinale	2.4	100	3.5	67	1.8	100	2.3	100	3.1	75
SHRUBS AND TREE SEEDLINGS										
Abies lasiocarpa	1.7	33	.2	67	.1	100	.3	33	.6	75
Artemisia tridentata var. vaseyana			.5	67			.9	33	.1	25
Pinus contorta			2.2	33	1.2	100	2.2	33	1.2	25

[1] On sites where species occurred.
[2] Among all sites in category
* = introduced species